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# An analysis of the Future Problem Solving Program and its impact on Massachusetts participants.

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# AN ANALYSIS OF THE FUTURE PROBLEM SOLVING PROGRAM AND ITS IMPACT ON MASSACHUSETTS PARTICIPANTS

A Dissertation Presented

by

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ABSTRACT

AN ANALYSIS OF THE FUTURE PROBLEM SOLVING PROGRAM
AND ITS IMPACT ON MASSACHUSETTS PARTICIPANTS

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Students need creative thinking, problem solving skills, and knowledge about the future to equip them to deal with our rapidly changing world. At the same time, Proposition 2 1/2 and a decrease in state aid are causing school systems to seriously tighten their budgets. Any programs considered "extras" are being eliminated or reduced, especially those targeted for our most able students, the gifted. One of these affected programs is the Future Problem Solving Program (FPSP). There is an unfortunate lack of information about the program and the impact it has on its participants. Although it has been implemented in various schools in Massachusetts since 1979, no studies have been undertaken about the FPSP in this state. Therefore, for this dissertation, an investigation was conducted into the roots, history, and impact of the program.

Questionnaires were sent to all adults who had registered as coaches for the FPSP in Massachusetts for

the 1988-89 school year. Students who participated during the same year were sent questionnaires through their coaches. Forty-six coaches (43.4%) and 513 students (75.66%) from grades four through twelve participated in the study. The questions in the surveys addressed information about demographics, perceptions of the impact of the FPSP on the student skills that the FPSP aims to develop, and the opinions and reactions of the coaches and students to the FPSP itself and their participation in it.

The respondees reported an increase in students' critical and creative thinking, communication skills, awareness of the future, and teamwork due to the FPSP. Research skills were also affected but to a lesser degree.

A variety of statistical tests were run on the collected data. Trends were noted and discussed such as the reported advantage in attainment of some skills by females and the positive impact of being on a FPSP team.

The FPSP was shown to fulfill its objectives in its participants in Massachusetts and should continue to be offered through the schools.

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# CHAPTER I

## INTRODUCTION

Throughout history, schools have been faced with many important issues. Among them are what students should learn, and how they can best be taught the skills they need. With an increasingly technological society, a question gaining in importance is how can students be equipped to deal with a changing world, particularly as active participants rather than passive recipients. "Since society changes ever more frequently and knowledge is growing geometrically, the importance of creative thinking and problem-solving skills is being recognized. These skills cannot simply be 'transmitted' -- gained through reading and watching films or attending lectures. These skills need to be permitted to nurture in all individuals." (Isaksen, 1983, p. 18). To address this issue, Torrance, Torrance, and Crabbe (1983) stated that "The most basic skill that can be taught in today's schools is problem solving, especially skills in solving future problems. In fact, the teaching of future problem solving skills [which is based on creative problem solving] may really be the key to the successful teaching of the other basics such as reading, writing, and arithmetic. Many children are not motivated to master the basics unless they can see the connection between them and their future lives." (Torrance, Torrance, and Crabbe, 1983, p.1).

At the same time, schools in Massachusetts are facing a serious tightening of school budgets caused by a combination of Proposition 2 1/2 and a decrease in state aid. School programs across the state have been decimated, especially those targeted for our most able students, the gifted. Enrichment programs, and even the Massachusetts Office for Gifted and Talented itself, have fallen victim to the budget axe and have been eliminated. School systems are being cut to bare bones by the budget crunch. Difficult decisions are being made by school boards across the Commonwealth as they search for ways to best use the funding they have left. Concern is mounting about the quality of education being offered our youth. Any programs considered "extras" are being eliminated or reduced by many school systems.

One of these affected programs is the little-known Future Problem Solving Program (FPSP). During the 1988-89 school year, 59 school systems took part in the FPSP. By September 1991, the number of school systems enrolled in the FPSP dropped to 38. (Personal communication with MFPSP State Director Ann Hoyle, Feb. 21, 1989 and Mar. 11, 1992). The objectives of the FPSP parallel many of the objectives of "Turning Points: Preparing American Youth For the 21st Century" (Carnegie Report, 1989). If the FPSP demonstrates that it fulfills its objectives and teaches valuable skills to students,

then it may be given added weight when school budget priorities are made. If alternative ways of implementing the program in schools can be determined, then it may be possible for some schools to offer the FPSP without making expensive or extensive changes in the existing school programs.

It is interesting to note that although the number of school systems registered with the FPSP has dropped, the total number of teams in the program in Massachusetts has remained steady. Because they considered the FPSP to be so valuable to their students, teachers sought alternate means of funding to pay the registration fees to enroll their teams. For example, Leominster has 20 FPS teams and is almost entirely funded by banks in their area. Other communities such as Easton, have had many parents volunteer to coach teams rather than having the program dropped. (Personal communication with Ann Hoyle, Mar. 11, 1992).

Although the support exists from the people directly experiencing FPS, little is generally known about the program.

## A. Statement of the Problem

The main problem with the Future Problem Solving Program in Massachusetts is the lack of information available about the program and the impact it has on its participants. Although it has been implemented in

various schools in Massachusetts since 1979, no studies have been undertaken about the FPSP in this state. Because of this absence of research, decisions are arbitrarily being made which may be detrimental to our youth and our future.

## B. Purpose

The purpose of this study is to describe the Future Problem Solving Program, as well as to gather data on how the FPSP is implemented in Massachusetts and what impact it has on its participants. The inquiry will address such specific questions as:

1) What is the FPSP? -- What are its objectives?
2) What is the history of the FPSP? -- How did it originate? How did Massachusetts become involved in the program?
3) What is the format of the FPSP? -- What is the FPS process? How are participants evaluated?
4) What are the roots of the FPS process? -- How does creative problem solving apply to the FPSP? How does future studies apply to the FPSP?
5) How is the FPSP implemented in Massachusetts? -- Who are the participants in Massachusetts? How is the program implemented in their schools?

6) What are the perceived effects of the FPSP? -- To what extent do students perceive certain skills as being developed by the FPSP? To what extent do their problem solving coaches perceive the students as developing certain skills from FPS?

Do the responses show that the FPSP fulfills its goals in the participants in Massachusetts?

7) What are the reactions of the participants to the FPSP? -- What special experiences do participants attribute to their involvement in the FPSP? What do they consider strengths about the program? What do participants consider weaknesses in the FPSP?

## C. Definition of Future Problem Solving

Future Problem Solving is a process for teaching students problem solving techniques to open-ended problems. FPS is based on the Osborn-Parnes method of Creative Problem Solving (Osborn, 1967; Parnes, 1967) and includes the added component of futuristics. The process of FPS involves both divergent and convergent thinking (See Appendix A). The steps are: researching the topic, brainstorming for problems, identifying an underlying problem, brainstorming for alternative solutions, selecting criteria, evaluating solutions, and describing the best solution.

## D. The Future Problem Solving Program

The FPSP is an international problem solving program with interscholastic competition available towards the end of each school year. Teams of students in grades 4-12 in schools across the country (and in other countries) work to solve real-life problems that, based on present trends, pose serious threats to society in the future. Trained evaluators respond to the teams' efforts and give feedback to help improve the teams' creative problem solving skills. Students work on practice problems during the school year. Practice problems increase in difficulty and are rated on a progressively stricter basis so that the students are improving their creative problem solving skills as the school year advances. When students enter the team competitions, they must group into teams of four. Teams may choose to participate on a non-competitive basis where they receive evaluators' comments but no score or ranking.

Students are guided by coaches who are trained in the FPSP. Coaches are taught the FPS process at regional workshops or on-site at their schools. Teachers, administrators, school personnel, or parents can be coaches.

Teams register for participation in the FPSP through their schools. Once their registration fee is paid ($100 per team in Massachusetts for the 1991-92 school year),

coaches receive information from the FPSP. The literature includes guidelines for the process, evaluation procedures, and materials about the specific topics for that year. Contact with the teams continues throughout the year in newsletters, updates, and other communications.

The culmination of the year is the International Future Problem Solving Bowl held in June. The best teams from across the United States and other participating countries are invited to compete. The International Bowl is a three-day olympic-styled series of events which include an opening ceremony, competition, a variety of mixer activities, and a closing awards ceremony. Teams chosen for this bowl have demonstrated their FPS talents in a series of competitions at the regional and state levels.

1. Background of the Future Problem Solving Program

The Future Problem Solving Program (FPSP) was initially developed in 1974 for the academically gifted. The FPSP was the brainchild of E. Paul Torrance, a professor of educational psychology at the University of Georgia and internationally recognized for his work in creativity and gifted education. The FPSP was Torrance's response to the concerns about the decline of creativity among Americans and an apparent lack in students of information about, and interest in, the future (Crabbe,

1985). "The development of the Future Problem Solving Program has been motivated by a belief that we have reached a point in civilization at which education must devote a considerable part of the curriculum to helping students enlarge, enrich, and make more accurate their images of the future." (Torrance, 1980, p.307).

Torrance long admired the work of Alex Osborn and Sidney Parnes, the originators of the Creative Problem Solving Process. Creative Problem Solving provides a structured method of approaching problems in an imaginative way (Maker, 1982). It is a process of finding facts, problems, ideas, solutions, and acceptance. Creative Problem Solving became the basis of the FPSP with the component of futuristics added. "Futuristics takes historical fact and scientific knowledge and adds human values and imagination to create images of what may happen in the future." (Cornish, 1977, p.51).

2. History of the FPSP

Torrance applied the Osborn/Parnes (1967) method of Creative Problem Solving to students by using problems relating to the future. In the summer of 1973, Torrance did preliminary work with interscholastic creative problem-solving. He worked with two groups of students -- one group of gifted children and one group of disadvantaged children (Torrance, Bruch, Torrance, 1976,

p. 119). Experiencing success with the summer programs, Torrance was invited to work with a group of gifted students at Clarke County High School in Athens, Georgia in 1974 and the first Future Problem Solving Bowl was held (Crabbe, 1985).

The original participants were very enthusiastic and wanted to continue with another Future Problem Solving Bowl. Other schools in the area asked to participate, and soon schools across the state became involved.

The concept spread to other states through the graduate students who were working with Dr. Torrance. As they graduated and moved into other areas of the country, they took their knowledge and enthusiasm of Future Problem Solving with them.

The Future Problem Solving Bowl officially became the Future Problem Solving Program in 1976 - 77 when it grew into a year-long program. The scope of the program expanded to include three practice problems. Feedback was given to the three practice problems and certificates for excellence were awarded. Thirty teams competed at the Bowl held in April. Ten teams represented each level of elementary, middle, and high school. Individual competition was also offered at the Bowl. During this year, over 3,000 students in grades 4 through 12 from over 150 schools actively participated in the program.

In 1977-78, formal participation doubled as over 6,000 students in over 300 schools from twenty states were directly involved in the Future Problem Solving Program. The program had become an interscholastic competition and a curriculum project in future studies and creative problem solving. At least 10,000 students in grades 4 through 12 were involved in some way in Future Problem Solving.

During 1978-79, participation grew by fivefold as approximately 30,000 students were directly involved in the Future Problem Solving Program. For the first time, individual states organized their own Future Problem Solving Programs and Bowls. These states then sent their winners to the National Bowl which had now been moved to Lincoln, Nebraska. Iowa, Louisiana, and Georgia were the first states to have state programs.

The 1979 National Bowl expanded to three days and included more events. Besides the team competitions, there was a scenario writing competition and competition for individuals. Premiering was the "solution selling" component where teams had to develop skits to "sell" their best solutions. Also offered during this Bowl were seminars and social events for participants, coaches, and parents. Fifteen teams from each school level (grades 4-6, 7-9, 10-12) competed at this Bowl.

By the spring of 1981, 18 states held state-level Future Problem Solving Bowls. Besides the original three states of Georgia, Iowa, and Louisiana, the additional states were: Alaska, Colorado, Florida, Idaho, Illinois, Massachusetts, Michigan, Mississippi, Montana, Nebraska, Oregon, Pennsylvania, Texas, Utah, and Washington. The winners of the state bowls automatically were invited to compete at the National Bowl. For those states without state-level bowls, teams performing at superior level on the third practice problem were invited to the National Bowl. These states were entered in the "open division" and were served by the national office for their practice problems.

In 1983-84, the Advance Division (now known as Community Problem Solving) was added to the Future Problem Solving Program. In 1984-85, the Program was further expanded to include grades K-3 in a non-competitive component of the FPSP. This is known as the Primary Division.

By 1984-85, twenty-nine states had state Future Problem Solving Programs. The new states were: Connecticut, Indiana, Kansas, Minnesota, Missouri, New Jersey, New Mexico, Ohio, Rhode Island, South Dakota, and Wisconsin. Additional states also enrolled in the "open division".

According to Anne Crabbe, the national director of the FPSP until fall 1991, the development of the Future Problem Solving Program had been marked by constant growth. Since its start in one high school in Athens, Georgia in 1974, the program has become international in scope involving approximately 200,000 students in all 50 states in the United States of America and 16 countries for the 1989 -90 school year. With its reputation expanding by word of mouth and published articles, the FPSP spread from the United States of America into the countries of Australia, Canada, Chili, Egypt, Germany, Great Britain, Hong Kong, India, Israel, Japan, New Zealand, Netherlands, Saudi Arabia, South Africa, and Taiwan. (Personal communication with Anne Crabbe, Aug. 15, 1990.)

3. Origins of the FPSP in Massachusetts

According to Ann Hoyle, State Director of the Massachusetts Future Problem Solving Program, the originators of the Massachusetts FPSP were three teachers of gifted/talented programs, namely, Marinel Johnson, Diana Reeves, and Maryann Haley. Johnson and Reeves taught in the Medfield Public Schools, and Haley taught in Concord, Massachusetts. Johnson and Reeves heard about the FPSP through graduate courses they were taking at the University of Connecticut while they were teaching. The three teachers originally registered their

teams in the Open Division of the national FPSP. (Personal communication with Ann Hoyle, March 29, 1992)

By the 1979-80 school year, the interest in the FPSP had grown and Massachusetts registered as a state division of the FPSP. (Personal communication with Ann Hoyle, Feb. 21, 1989) The MFPSP as it was now called, was opened to all schools in the state. It was publicized through gifted and talented programs and MAAIP (Massachusetts Association for the Advancement of Individual Potential), and had the Honeywell Corporation as its sponsor. The first Massachusetts State Future Problem Solving Bowl was held at the Sharon Jr. High School and was attended by 13 FPSP teams.

Since its humble beginnings, the MFPSP has grown and is now taught to approximately one thousand students from kindergarten through grade twelve in Massachusetts each year. During the present year, there are 161 registered teams in the competitive division of the FPSP in MA. Of these, 95 teams represent the Junior Division (grades 4-6), 50 teams are from the Intermediate Division (grades 7-9), and 16 teams come from the Senior Division (grades 10-12). (Personal communication with Robert Vaughan, Feb. 21, 1992) Thirty-eight towns from across Massachusetts are represented by these teams.

4. The FPSP in Massachusetts

FPSP teams consist of four members plus an alternate. In Massachusetts, FPSP coaches register their teams with the state division of the FPSP. (Some states do not have a state-level FPSP so their teams register in the Open Division.) The methods the coaches use to choose their teams varies from school to school. Some coaches have students compete for positions on the team by demonstrating their abilities in the FPS process. Other coaches have students themselves select the team members from a group that has worked together. Many students can learn and practice the problem solving techniques but only groupings of four can enter competitions in the team category.

In the FPSP, there are four team levels based on the highest grade of the team members: kindergarten through grade three, the Primary Division, work in a non-competitive capacity; grades four through six are considered the Junior Division; grades seven through nine are the Intermediates; and grades ten through twelve comprise the Senior Division. Students compete against other teams in their division. Evaluation for the junior, intermediate, and senior teams takes place through the Massachusetts FPSP. "Winners" are those teams that score the highest number of points from an evaluation by trained personnel of their written

responses to a given scenario. Primary level work is scored at the National FPSP Evaluation Office.

There are three practice problems. Feedback from trained evaluators on these practice problems helps teamsSince there is some variability in the way the program is run in the individual states, the following information is based on the experiences of the program in Massachusetts. The first practice problem involves only the first three steps of the process. The second practice problem requires all six steps to be completed. These problems are written out at the convenience of the teams but by a required deadline. Then the "packets" -- the written responses (see Appendix B), are sent to a state chairperson to be scored by evaluators. The responses and scores of the evaluators are sent back to the teams. The feedback consists of positive comments pointing out both the strengths of the team and suggestions for improvements in the areas that show weaknesses.

In previous years, the third practice problem had to be completed with the six steps like the second practice problem, but under special conditions. It had to be finished within two hours; no pre-written materials were allowed in the room during the writing; and only the four team members could be present. The adult supervisor of the team, the coach, could not help out in any way during

the actual writing of the packet. The teams from each division across the state that scored the highest number of points from this third practice problem were invited to the State Future Problem Solving Bowl.

Starting with the 1988-89 school year, the FPSP in Massachusetts held Regional Bowls. The third practice problem takes place in a bowl setting instead of being sent in to the evaluators. Teams compete against other teams on location from their area of the state. There are three locations with the state roughly divided into the eastern, central, and western sections. High scoring teams are invited to participate in the State Bowl.

The state level of competition is held at a chosen site (usually the Massachusetts Institute of Technology). All invited teams are sequestered for two hours to respond to the state problem. The highest scorers from each division are then invited to compete against the top scorers from the other states and participating countries at the International Conference.

5. <u>The FPS Process</u>

The process for the Future Problem Solving Program includes researching a pre-determined topic, reading a future scenario based on that topic, analyzing the scenario, brainstorming for problems from a multi-faceted point of view, and developing creative solutions for a chosen underlying problem. Criteria are then developed

to evaluate the solutions. The best solution is chosen and then the details are elaborated explaining how the solution would be put into effect. The research phase is completed before the scenario is given. The rest of the process takes place during a given period of time which, during competition, is two hours.

a. FPSP Topics

Several possible topics are chosen at a meeting of the state and national directors of the Future Problem Solving Program. They base their selections on real-world issues, appropriateness of the topic, and availability of sources for research. They include both science and socially related issues. Those topics are sent to the teams across the country who vote on the topics in which they would be most interested (See Appendix C). The results of the votes are compiled and five topics are chosen for the school year. All participating teams work on the same topics and in the same order. For example, the 1988-89 topics were Sources of Energy, Kids and the Law, Nutrition (for the Regional Bowls), New Forms of Employment (for the State Bowl), and Terrorism (for the International Bowl). The 1991-92 topics were Space Exploration, the Legal Epidemic, Sports Ethics (for the Regional Bowls), Land Use (for the State Bowl), and Advertising (for the International Bowl). Previous topics included The Elderly, Acid Rain,

Artificial Intelligence, The Greenhouse Effect, and Changing Family Structures.

b. Preparation

Before students begin to write responses to the future scenario, they must gather as much information as they can. Their research takes place over a period of several weeks. A resource manual is available through the FPSP. This book contains information about the first four topics including related terms and definitions, and a synopsis of readings appropriate to the topics. Use of a variety of sources (especially primary sources), is encouraged. Exposure to experts in the particular fields through readings, films, guest speakers, and field trips, helps students to gain insight into the issues.

c. The FPSP "Fuzzy"

The scenario, known as the "fuzzy situation", is a one to two page description that gives an overview of life at some point in the next century. Its purpose is to narrow down the overall topic. Students must read and analyze the information from the fuzzy very carefully and base all their responses as if the given year of the scenario was the present year (See Appendix D).

d. Brainstorming

"Brainstorming is the key to successful creative problem solving [upon which the FPSP is based]. It encourages spontaneity, group unity, and oral expression.

The small groups gain a trust in telling their ideas without criticism, and they learn the importance of each person's contribution in the total outcome and output of the group. Small group experience paves the way to comfortable creative problem solving techniques." (Torrance, Torrance, & Crabbe, 1983, p. 11).

A key technique important to the FPSP process is brainstorming. There are four basic rules for ideation (brainstorming) (Osborn, 1967; Crabbe, 1985): 1) Criticism is ruled out. 2) Free-wheeling is welcomed. 3) Quantity is wanted. 4) Hitchhiking is encouraged. Since judgmental thinking tends to limit creative thinking, an atmosphere of acceptance where all ideas are allowed is essential. This is why criticism at this stage of idea development is ruled out. Free-wheeling encourages unusual, wild, and even totally offbeat ideas, allowing creativity to reign. The greater the number of ideas generated, the greater the probability that some of them will be of high quality. The weakest ideas will be eliminated later on when participants start to evaluate their responses. Called hitchhiking, ideas can be combined or built upon. At this point, some of the more bizarre ideas may take on a more practical form.

e. The FPSP Packet

The packet consists of a booklet of forms that delineate the six steps of the problem solving process

(see Appendix B). These steps are: 1) problem identification, 2) underlying problem, 3) alternative solutions, 4) criteria, 5) grid to evaluate solutions, and 6) implementation of the best solution.

The first step is the Identification of Problems. Based on the information given in the fuzzy, team members must identify twenty problems that could occur if the given situations continue. Because no one can predict exactly what will happen, the problems have to be written in terms of probability. For example: "The elderly could experience a higher rate of depression and give up the will to live if many of their friends die before them." Other guidelines for problem writing include: the problems must be written in full sentences, they must relate to the fuzzy, and they must explain why they are problems.

The Underlying Problem is the second step of the packet. From all the problems that the team identified, they must choose one that will be the basis for their solutions. The problem cannot be a restatement of the fuzzy because it would be too broad. The underlying problem cannot be too narrow either, or it will be too difficult to find twenty solutions. It must be written in the form "How might we..." or "In what ways might we..." It must have a strong key verb phrase describing what is targeted for action and a "so that" phrase

describing the purpose of the action. Also, the parameters of topic, place, and time need to be stated. For example: "In what ways might we produce cleaner alternate energy sources in North America so that its citizens will have a better environment, now in 2015, for themselves, and for future generations?"

The next step is to find twenty solutions to the underlying problem. These solutions must be written in the definite form stating "who" will do "what" and "why". Including when and where the action occurs are encouraged. The solutions must relate to both the key verb phrase and the purpose of the underlying problem. A well written solution to the previously stated underlying problem would be "Power companies will build electrical plants near the coastline that convert wave motion to electricity. These will provide energy and not pollute the environment."

Step Four - Developing Criteria, involves writing five questions that will be used to evaluate the solutions. Criteria must be in the form "Which solution will...". They must also contain the superlative degree and relate back to the underlying problem. For example: "Which solution will be the most protective for the environment of...?"

The fifth step is the grid. Teams choose their ten best solutions out of their twenty original solutions.

The ten solutions are listed down the side of the grid and are then evaluated using the criteria. A numerical value is given to each solution based on a one to ten scale. Ten points are given to the solution which best fits the criterion and so on down to one point for the solution which least fits the criterion. Each value can be used only once in each vertical column. The rows are added horizontally. The solution with the greatest number of points is called the Best Solution. (See Sample Grid from The Evaluation Primer, p. 64).

Table 1

Sample FPSP Grid

| ALTERNATIVE SOLUTIONS | CRITERIA 1 | 2 | 3 | 4 | 5 | TOTAL |
|---|---|---|---|---|---|---|
| 1. Going to moon #10 | 2 | 3 | 1 | 1 | 10 | 17 |
| 2. E.T. and people #12 | 1 | 1 | 4 | 4 | 5 | 15 |
| 3. Canned food #4 | 10 | 10 | 9 | 10 | 2 | 41 |
| 4. Dome-proof radiation #7 | 5 | 4 | 5 | 3 | 7 | 24 |
| 5. Nitrous oxide #18 | 4 | 8 | 6 | 5 | 1 | 24 |
| 6. Robots #9 | 7 | 9 | 3 | 7 | 9 | 35 |
| 7. Dead bodies #5 | 3 | 2 | 10 | 2 | 6 | 23 |
| 8. Medical equipment #14 | 9 | 7 | 7 | 9 | 4 | 36 |
| 9. Natural resources #15 | 8 | 5 | 8 | 8 | 3 | 32 |
| 10. More domes #11 | 6 | 6 | 2 | 6 | 8 | 28 |

The sixth and last step of the packet is the Elaboration of the Best Solution. Teams must explain in detail the who, what, when, where, why, and how of their Best Solution. They must relate the Best Solution back to the Underlying Problem since the Underlying Problem determines what they set out to do, and the Best Solution is their proposal for solving the problem.

6. The Evaluation Process

In The Evaluation Primer (1990 Edition), Gordon Shewach, the national evaluation director for the Future Problem Solving Program, explained the evaluation process. He stated that the most important part of the evaluation process was the feedback given to the teams. The purpose of feedback is to help teams understand their strengths and weaknesses and motivate them to improve their skills so they can grow in creative problem solving.

The FPSP encourages evaluators to follow the scheme devised by Edward de Bono (1974), who identified four areas of response in evaluating problem solving for students. These areas are praise, clarification, criticism, and amplification. Honest praise should be given for the major strengths that are shown. Evaluators should point out unclear statements so students can improve in clarification. (Since one of the major goals of the FPSP is to develop communication skills,

clarification is important). Criticism is necessary to point out the skills that could be improved but should be specifically directed rather than generally stated. Amplification allows evaluators a chance to help students expand their thinking, push their ideas farther, and improve the quality of their problem solving and planning. Evaluators amplify by giving suggestions for follow-up and elaboration.

a. Types of Scales

There are four kinds of scales in the evaluation of the written FPSP packet. In rating scales, points are given according to how teams compare with each other. In frequency scales, points are awarded on the actual number of responses that meet the given criteria. Weighted scales are used where bonus points are awarded for original ideas. (For the purposes of the FPSP, original ideas mean those responses that are found infrequently and are of high quality thought.) In composite scales, points are awarded based on a composite total of points earned on individual elements (See Appendix E).

b. Types of Criteria

There are three types of criteria used to award points in the FPSP evaluation: content, structure, and process. The quality of the ideas presented by the students are judged in the content-oriented areas.

Structure-oriented criteria judge how well the students fit the prescribed format in their work.
Process-oriented criteria judge how well the students have used the FPS process (See Appendix E).

c. Scoring of the Packets

Packets are scored by evaluators trained in the Future Problem Solving Process. Most areas earn a maximum of ten points (See Appendix F).

"Problems" identified in Step 1 are scored on the basis of fluency, flexibility, clarity, and originality.

Fluency (1-10), the number of accepted problems, is determined by a scale that depends on frequency.

| Number of Y's | Number of Points |
|---|---|
| 13 - 20 | 9 - 10 |
| 10 - 12 | 7 - 8 |
| 7 - 9 | 5 - 6 |
| 4 - 6 | 3 - 4 |
| 1 - 3 | 1 - 2 |

Flexibility (1-10), the amount of differently focused problems, is evaluated by the number of categories (maximum of ten) addressed by the accepted problems. (The categories are business & commerce, transportation, social relationships, environment, education, technology, recreation, government & politics, ethics & religion, arts & aesthetics, physical health, psychological health, basic needs, defense, economics,

and law & justice, and communication. A miscellaneous category is included that can be modified for specific topics such as "safety" for Space Exploration.)

Clarity (1-10) is based on communication skills. Are the problems clearly and thoroughly described?

Originality (3x) applies to problem statements that are rare and are of high quality. The number of "original" problems are multiplied by three points.

Step 2 - "The Underlying Problem" is judged on completeness, adequacy, and focus.

Completeness (0-10) is the total of points for the form in which the Underlying Problem is written.It must include a stem "How might we" or "In what ways might we," with a Key Verb Phrase (worth zero or four points), the Purpose of the KVP (worth zero or four points), and the Fuzzy Situation Parameters which include time, place, and topic (worth from zero to two points).

Adequacy (1-10) points out the importance of the problem chosen for Step 2. How will it impact on the fuzzy situation if it is solved?

Focus (1-10) evaluates the narrowing of the fuzzy situation. Is the Underlying Problem a significant subproblem of the fuzzy?

Step 3 - "Alternative Solutions" are evaluated for fluency, flexibility, elaboration, and originality. Fluency (0-10) for solutions means the solutions that are

relevant to the Underlying Problem. Relevant means that the solutions respond to both the key verb phrase and the conditions of the problem statement. The same ten-point scale is used for fluency for solutions and fluency for problems.

Elaboration (0-10) means solutions to the Underlying Problems that are written out in detail. Each solution must have any three of "who, what,why, or how or a substantive when or where" to be marked as elaborated. The points given for elaboration are determined by a rating scale. Judgement is made according to how teams compare with each other. Excellent - 9 or 10 points, Good - 7 or 8, Fair - 4 to 6, Poor - 1 to 3.

Flexibilty (1-10) counts the number of categories addressed by the relevant solutions (up to a maximum of ten).

Originality (3x) applies to elaborated solutions that are rare and of high quality. Each original solution is rewarded by an additional three points.

Step 4 - "Criteria" are rewarded if they are correctly written, and by their applicability and relevance to the Underlying Problem.

Correctly written (0-5) means that the criteria has one main idea, includes a superlative, and has a positive direction (best instead of worst). One point is given for each criterion that is written correctly.

Applicability and Relevance (0-10) is scored by giving one point to each criterion that is an important consideration in evaluating solutions applicable to the Underlying Problem. Two points are given to each criterion that is targeted, that is specifically applicable and relevant to the Underlying Problem.

Step 5 - "Grid" points (1-5) are given on the basis of the correct use of the grid. This means that each number from 1 to 10 is used only once in each column, and that the scores are correctly totalled. Also, the highest scoring solution must be chosen to be the Best Solution.

Step 6 - "Best Solution" is judged on relevance, effectiveness, impact, and humaneness. Relevance (1-5) is scored according to the extent of the pertinence of the Best Solution to the Underlying Problem.

Effectiveness (1-5) judges how well the Best Solution will solve the Underlying Problem.

Impact (1-5) measures the positive effect of the Best Solution on the Fuzzy Situation.

Humaneness (1-5) shows the productive, positive potential of the Best Solution. On the one to five point scale, the least humane Best Solution receives one point where the most humane is given five points.

The final section of the evaluation score sheet has two areas for scoring: research applied and creative strength.

Research Applied (1-10) measure's the teams use of research available on the topic. It includes terms, concepts, and flexibility in the application of the information.

Creative Strength (1-10) assesses the overall creativity of the responses in the booklet. Are innovative ideas presented, new perceptions, or unusual combinations evident.

## E. Other Components of the FPSP Program

Besides the team competition, the Future Problem Solving Program offers other types of activities to address the different learning styles and sets of talents of gifted students.

### 1. Solution Selling

Solution selling is a separate competitive event (See Appendix G) held during Future Problem Solving Bowls at the regional, state, and international levels. It is a five-minute presentation given by the Future Problem Solving teams to an audience composed of other teams, coaches, parents, and observers. The goal of the presentation is to convince the audience (especially the judges), that the team's best solution (from the packet they developed that morning), should be implemented. To

prepare, teams are given a bag of assorted odds and ends of various materials to make into props. They are given 1 1/2 hours to develop a skit and make their props. An adult "coach" is with them during their preparation but cannot take part in the skit. The purpose of the presentation is to develop communication skills, particularly the skill of persuasion. It is also a vehicle for creative expression through the use of the materials to make props. Skits are judged and awarded independently of the written packets.

2. Individual Future Problem Solving

Individual Problem Solving is offered at state and international competitions. Outstanding students whose teams did not qualify for the team competition have the opportunity to complete a modified packet as an individual. The same fuzzy is given to the teams and the individual competitors. All competition requires the completion of the six steps of the problem solving process. The difference between team and individual divisions is that individuals only need ten (instead of twenty) problems and solutions.

3. Community Problem Solving

Originally known as the Advanced Division of the FPSP, Community Problem Solving involves identifying and attacking a present, real-life problem usually found within a team's own community or in a nearby community. A

report on what action is taken is submitted to the state director for evaluation (See Appendix H). The top scorers in the state are sent to the international board for further evaluation. The top team in each division (Junior, Intermediate, and Senior), from across the states receives an invitation to the International Future Problem Solving Bowl.

4. Scenario Writing.

Students are invited to submit futuristic scenarios of 1,500 words or less. These creative writings are related to the Future Problem Solving Program topics of that school year. These stories are submitted and scored (see Appendix I) in advance of the State Future Problem Solving Bowl. The three top scenarios in each division are published in a booklet for distribution at the bowl. The winning state scenarios are sent to the national board for comparison with those submitted by the other states. The national winners are chosen and receive an invitation to present their scenarios at the International Bowl.

5. Visual Arts

Another form of competition took place at the state level during the 1988-89 school year. Art projects related to the year's Future Problem Solving topics were sent a day in advance to the State Future Problem Solving

Bowl. They were judged by a special panel and were on public display during the State Bowl.

This activity is no longer included as part of the Massachusetts FPSP. Partially due to budget restrictions and the elimination of electives including art in many school systems in Massachusetts, the visual arts competition was canceled after the 1989-90 school year (Personal communication with Ann Hoyle, Jan. 1992).

## F. Outline of Dissertation

Chapter I of the dissertation contains a discussion of the problem of the lack of knowledge of the Future Problem Solving Program and the benefits the program offers to its participants. What the Future Problem Solving Program is, how it started, how it works, and how its participants are evaluated are detailed. The objectives of the program and the skills it claims to enhance are listed.

Chapter II involves a review of the existing literature about the roots of the Future Problem Solving Program and the impact of the FPSP on its participants. The origins include the Osborn-Parnes Model of creative problem solving and futuristics. Resources included searches of the Educational and Psychological abstracts, contact with the national head of the FPS Program and the state director. Also the information available through the publications from the FPSP were researched.

Chapter III includes information about the questionnaires, the population to whom they were sent, and the method of their distribution. How the target population was chosen, who they were, and why they were asked to respond to the survey is discussed. How the surveys were developed and distributed is detailed. Methods used to analyze the information are noted.

Chapter IV includes the analysis of the gathered data. Charts display the numerical data according to the responses. Lists are categorized and detailed to report the essay answers. Trends are documented.

Chapter V notes the conclusions reached from the analysis of the data. Does the research show that the Future Problem Solving Program fulfills its goals in the opinions of the participants in Massachusetts? Should the FPS Program continue to be offered in schools? Is the program worthwhile enough to add to schools that don't offer it now? What are the various ways the program can be implemented? Are there any advantages in the way the program is run in different schools? What, if any, advantages does the program offer to the community? Recommendations for further research are also included.

## G. Significance

By analyzing the impact the FPSP is having on students and their coaches across Massachusetts, this

study will help educators decide whether the Future Problem Solving Program demonstrates the potential to teach valuable skills to their students. Do the participants in the program perceive it to fulfill its objectives: encourage creative thinking, stimulate their knowledge of the future, promote interdependency through teamwork, help develop critical thinking skills, and help students communicate clearly both in oral and written form? (Mass. Dept. of Education, 1988) School boards can then choose to what extent the FPSP should be implemented in their schools. Since the issues of what and how to best educate our youth are typical across the country, this study can be used to help school systems in other states make informed decisions about including the FPSP in their academic programs.

This study can also act as a catalyst to give schools new ways to promote community involvement and parental support, always important considerations in educational endeavors.

# CHAPTER II

## REVIEW OF RELEVANT LITERATURE

The direction for this study was to research the origins of the Future Problem Solving Program, the objectives of the program, the beginnings of the FPS Program in Massachusetts, the ways the FPSP was implemented in this State, the effects of the program on participants, especially in Massachusetts and whether the objectives of the FPSP were being realized.

Since the Future Problem Solving Program is based on the Osborn-Parnes model of creative problem solving, the areas of creative problem solving and its components -- creativity and problem solving, were investigated as they apply to education.

The other major component of the FPSP is the area of "futuristics." The role of future studies as it applies to society and especially to education was researched.

Since the Future Problem Solving Program was designed for gifted students, the needs of gifted students were researched and the appropriateness of the FPSP for the gifted was analyzed. What the Future Problem Solving Program potentially offers to all students was also investigated.

### A. Importance of Problem Solving

As society increases in complexity, so too do the problems that people face. In Turning Points (1989), the Carnegie Corporation stressed that the ability to think

flexibly and creatively in order to solve problems is important to all, not just an elite few. Discussing the skills necessary for our future workers, the Carnegie researchers stated that "Successful participation in a technically based and interdependent world economy will require that we have a more skillful and adaptable workforce than ever before -- at every level from the factory floor to top management." (Carnegie Corporation, 1989).

Isaksen (1983) also noted the importance of creative thinking and problem-solving skills. However he also stated that "These skills cannot simply be 'transmitted' -- gained through reading, watching films or attending lectures. These skills need to be permitted to nurture in all individuals." (Isaksen, 1983, p. 18). In other words, problem-solving and creative thinking should actively be taught.

## B. Problem-Solving Models

Before developing a method to teach problem-solving, a model of the steps that occur in problem-solving must be devised. Several models were developed that eventually led up to the process used in the Future Problem Solving Program.

According to Guilford in Frames of Reference for Creative Behavior in the Arts (1967), the first attempt to create a model to show the sequencing of events in

problem solving came from John Dewey in How We Think (1910). In Formative Years in American Education, (1965) Thayer pointed out that Dewey thought students should: 1) have a genuine situation of experience, 2) have a genuine problem develop as a stimulus to thought, 3) possess the information and make observations needed to deal with the problem, 4) suggest solutions and be responsible for developing them in an orderly way, and 5) have the opportunity to test their ideas by application.

Dewey's analysis of thinking were nearly revolutionary for education: they inaugurated reform in the methods of teaching and principles in the selection of subject matter; caused reforms in the organization of curriculum; and were responsible for changes in the life of the school. (Thayer, 1965, p. 264) "One function of the school, insisted Dewey, is to provide an environment in which the young can acquire the discipline (the habit) with which to meet the challenges of change." (Thayer, 1965, p. 263) This view contrasted with traditional education. Students would now be looked upon as active participants in their own learning. He considered their problem-solving to be intimately involved with the past, present, and future.

In 1926, Graham Wallas presented a four step process in problem solving in his book The Art of Thought. His steps involved: 1) preparation, 2) incubation, 3)

inspiration, and 4) evaluation. During preparation, the information is collected. Incubation involves the temporary pause or relaxation of effort so that the data can be processed. Inspiration involves the "Aha!," the moment of insight as new ideas are generated. During evaluation, choices are made and elaboration of the created product takes place. J. Rossman in The Psychology of the Inventor (1931), considered the following steps necessary to invent something new: 1) a need or difficulty is observed, 2) the problem is formulated, 3) the available information is surveyed, 4) solutions are formulated, 5) solutions are critically examined, 6) new ideas are formulated, and 6) new ideas are tested. J.P. Guilford considered these previous three problem-solving models as progenitors of his "Structure of the Intellect" which he published in 1965 (Gowan, Demos, & Torrance, 1967). The categories of the three dimensions of his cube are Contents, Operations, and Products. Guilford listed the following steps as the Operations side of his model: 1) cognition, 2) memory, 3) divergent production, 4) convergent production, and 5) evaluation with divergent production being the most applicable to the creative problem solving process.

While Guilford was developing his Structure of the Intellect, other investigators were considering creative problem-solving. In 1957, in Applied Imagination,

Osborne listed phases for the creative process. They were: 1) orientation, 2) preparation, 3) analysis, 4) ideation, 5) incubation, 6) synthesis, 7) evaluation. Refined, these phases became the Osborn-Parnes Model of the Creative Problem Solving Process. The steps are: 1) fact finding, 2) problem finding, 3) idea finding, 4) solution finding, and 5) acceptance finding. (Parnes, 1987).

In 1974, E. Paul Torrance combined the Osborn-Parnes Model of the Creative Problem-Solving Process with the study of futuristics to create Futuristic Creative Problem Solving. The application of this process has developed into the Future Problem Solving Program. The steps of future problem solving are: 1) researching the problem, 2) brainstorming problems, 3) identifying the underlying problem, 4) brainstorming solutions, 5) selecting criteria, 6) evaluating solutions, and 7) describing the best solution (Crabbe, 1985a).

C. Relationship of Creativity and Intelligence

According to Getzels and Jackson in Creativity and Intelligence (1962), human intellect has two cognitive modes. One of these modes, intelligence, represents intellectual acquisitiveness and conformity. The other mode, creativity, represents intellectual inventiveness and innovation. Intelligence focuses in on what has already been discovered; creativity concentrates on what is yet to be known.

Until the 1950's, creativity and intelligence were considered to be directly related; it was assumed that the higher the intelligence, the greater the creativity of an individual. One of the turning points came with Guilford's address to the American Psychological Association in 1950. In this address, Guilford questioned the connection between intelligence and creativity. He predicted that low correlations would be found between intelligence test scores and creative performance. This stimulated a dramatic increase in the study of creativity. As stated in Creativity, Intelligence, and Problem Finding: Retrospect and Prospect, several studies substantiated Guilford's prediction (Getzels, 1987).

Getzel and Jackson (1962) set out to discover if there was a correlation between those who measured high in intelligence and those who had high creativity. Their findings concluded that "at the high average level of intelligence and above, creativity and intelligence are sufficiently independent to warrant differentiation." (Getzel & Jackson, 1962, p.26) Torrance (1960) replicated parts of the study and found that there was a positive, but not high relationship between intelligence and creativity as measured by IQ and divergent thinking measures.

Mackinnon (1975) pointed out that although there was a certain minimum level of intelligence required before creativity was exhibited, the more intelligent person was not necessarily the more creative one.

Another result of the Getzels and Jackson study (1962) was that scholastic achievement (as measured by standardized achievement tests) was equal in superiority between the highly intelligent who were lower in creativity, and highly creative who were lower in intelligence groups. Although questions exist about how well standardized achievement tests measure academic achievement, these tests are useful in that they reveal interindividual differences in a school system, state, or country (Kirk & Gallagher, 1986, p. 36). These results were substantiated by Wallach and Kogan (1965) who also found the highly creative and highly intelligent groups to have equal achievement. The group that attained the highest achievement was the group composed of those who were BOTH highly intelligent AND highly creative (Maker, 1982b).

What implications does this have for the education of the gifted? In Background and History of the Gifted-Child Movement, Gowan (1977) wrote that the gifted were a pool for potential creativity. Maker stated that if intellectually gifted but not necessarily creative individuals have the potential to be more original, and

if they can be more effective achievers by using both intelligence and creativity, then teachers must provide experiences such as creative problem solving that will increase the chance of students using all their potential abilities (Maker, 1982b, pp. 201-202). Thus activities such as the Future Problem Solving Program are important for intellectually gifted students to help raise their creative potentials. By developing both their intellectual abilities and their creative thinking, greater potential can be more readily reached.

## D. Creativity

Since intellectual inventiveness and innovation (creativity) are components of creative problem solving, and the Osborn-Parnes method of creative problem solving is the basis to the Future Problem Solving Program, an investigation into these areas was necessary to clarify the roots of the FPS Program. This researcher explored several aspects of creativity: selection of who has creativity; factors involved in creativity; the teachability of creative thinking; and creative problem solving - its structure, use and effectiveness.

According to Alex Osborn in Applied Imagination (1967), the cornerstone of human endeavor is imagination. Tapping in to that imagination and using it to take novel approaches to situations is using creativity; in other words, applying imagination. Osborn believed strongly in

the importance of creativity and he attributed humans' survival as animals and as civilized beings to possessing the imagination necessary for creativity. "The history of civilization is essentially the record of man's creative ability." Even now, with all the advances of the 20th century, "Modern society, with its emphasis upon progressive synthesis of technological and pure science, is admittedly dependent upon imagination [and its application - creativity] as its life-blood." (Osborn, 1967, p.viii).

Before investigating creativity training in individuals, it was necessary to research whether experts in the field consider all humans to possess creativity and whether this trait could be taught. For hundreds of years, creativity was considered to be a divine gift. It was believed that those rare few who possessed creativity had to have been born that way.

Strides were made in the understanding of creativity in each person in the early 20th century when psychologists moved from studying humans in general to scientifically investigating individual differences. It was realized that individuals differed in their psychological traits, not only in the variety of their qualities but also in the degrees of the traits they possessed. This concept of individual differences was seriously applied to creativity around 1950 (Guilford,

1967; Shallcross, 1981). It was found that all humans have some degree of creativity (Osborn, 1967; Shallcross, 1981), or as Hennessey and Anabile (1987) call it, creative potential. It was also found that limits attainable by each individual were set by heredity, but creativity could be extended within those constraints (Guilford, 1962b). In other words, creativity can be taught within the natural limits of each person's potential.

1. Need for Creativity

By the 1960's, the world was in the midst of dramatic changes. More creative solutions were needed for many of the problems that faced society. As Guilford pointed out in Factors That Aid and Hinder Creativity (1962) employers began to look for scientists, engineers, and managers who could be more inventive. Educators looked for more productive thinking from their students. Even on an international level, the need for creativity was seen as the world faced critical problems such as producing and distributing enough food to feed the world, and keeping peace. These, and other real-life issues such as acid rain, medical advances, and the elderly, later became topics for the Future Problem Solving Program.

Lowenfeld (1962) pointed out how powerful creativity can be and how necessary it is to use this power in

positive ways since creativity can be used in negative and in positive ways. "In an age of increasing juvenile delinquency and mental illness, in an age where man seems threatened with self-extermination because of the wonderful forces his mind has unleashed, we must find ways to use this mind-power creatively -- to build rather than to destroy." (Lowenfeld, 1962, p.17).

Using creativity is seen by some as a way to develop human potential (Parnes, 1971; Torrance, 1962). Not only is creativity useful for society, it is important to the individual. Parnes wrote that "Failing to use mental resources is wasteful to both society and the individual." (Parnes, 1971, p. 19). Torrance adds that creativity can encourage the individual's mental health (Torrance, 1962).

2. What is Creativity?

Creativity has many definitions, usually involving a process or a product (Arnold, 1962). Almost all definitions involve the production of something new or original (Deroche, 1968; MacKinnon, 1967).

According to MacKinnon in Identifying and Developing Creativity, true creativity fulfills at least three conditions: "1) it involves a response that is novel or at least statistically infrequent, 2) it must be adaptive to reality in some sense -- solve a problem, fit a situation, correlate with reality in some way"

(MacKinnon, 1967, p. 228), and 3) there should be a sustaining and developing of it to the full (evaluation and elaboration).

Since creativity is desirable, it is important to know what characteristics are inherent in people who are acknowledged as creative. Criteria for creativity for creative art students were developed at Penn State (Lowenfeld, 1962). At about the same time, J. P. Guilford developed a set of criteria for creativity based on an analysis of creative scientists and engineers (Arnold, 1962). Lowenfeld discovered "a striking similarity between creativity in the arts and those which Guilford found to be required for creativity in the sciences" (Lowenfeld, 1962, p. 12). This meant that there was a common set of characteristics to creativity, exclusive of the form of product to which the creativity led.

According to C.M. Callahan in Developing Creativity in the Gifted and Talented (1978), J. P. Guilford stated that one of the basic operations involved in creative thinking is divergent production. Divergent production is the "ability to produce many, varied responses or solutions to a given task or question" (Callahan, 1978, p. 6). Broken down, the four components of divergency are: fluency - the ability to generate many ideas; flexibility - the ability to produce a variety of ideas

or approaches; originality - the ability to produce ideas that are off the beaten track; and elaboration - the ability to produce a new idea by adding detail to an already existing idea. E. Paul Torrance, the creator of the Future Problem Solving Program, included these abilities in the evaluation of the written responses of the Future Problem Solving packets (Torrance, 1977). These components of divergent thinking are also included in the Torrance Test of Creative Thinking, which is widely used to measure creative ability in individuals.

Creativity is an important skill to gain and use information. Osborn wrote that to think creatively, to use one's creative imagination, "is itself a basic tool in the acquisition of knowledge; for knowledge becomes more usable when imaginatively synthesized and dynamically extended" (1967, p. vii).

Torrance agreed that creative thinking is important to learning. In Creativity in the Classroom (1977), he stated that children's creative thinking abilities are useful in acquiring traditional educational skills as well as problem-solving skills. The usefulness of creative thinking goes beyond childhood and formal education. Torrance stated that creative thinking is essential to the application of knowledge to daily personal and professional problems.

3. Can Creative Thinking Be Taught?

Schools are overwhelmed with a vast amount of information and skills to teach, and many school systems (especially in Massachusetts) are facing decreased budgets to fund staff and materials. Before one advocates continuing or adding creative thinking to the curriculum, it is important to ensure that creative thinking is teachable.

By 1959, studies showed that creative thinking could deliberately be developed. (Parnes, 1987) Torrance reported that creative thinking in the form of divergent activity could be improved since "even after 20 minutes of instruction on the nature of divergent-thinking processes, grade-school children showed a clearly observable improvement in performing tasks of this type" (Torrance, 1967, p. 5).

In Is Creativity Teachable? (1973), Paul Torrance and J. Pansy Torrance looked at 142 experiments to find out if creativity in the form of creative thinking was teachable. They found the overall success rate to be 72%. The most successful of the studies were the 22 experiments that used the techniques of the Osborn-Parnes creative problem solving model. These experiments were 91% successful in teaching children to think creatively.

Not all studies agree that creative thinking can be taught. Rose and Lin (1984) cited findings by Mansfield,

Busse and Krepelka (1978), that found five major creativity training programs to be relatively ineffective. Cronbach (1970), Kogan and Pankove (1974), and Wallach and Wing (1969) criticized there views that stated that deliberate educational programs could significantly increase creative productivity. Rose and Lin conducted their own investigation using meta-analysis, the formal statistical method developed by Glass (1978), which assesses the magnitude of the effect. This technique allows a variety of findings to be quantitated, standardized, and compared across studies. Their study confirmed that creative thinking could be developed through various teaching techniques. Again, the use of the Osborn-Parnes creative problem solving program, the precursor to the Future Problem Solving Program, proved to have the most consistent impact on verbal and figural creativity. Feldhusen and Clinkenbeard (1986) in their review of the research on instructional creativity, found that it is possible to teach creative thinking through a system of materials and procedures in the schools. They substantiated their findings by quoting several studies and several programs. Among the researchers discussed were Treffinger and Ripple (1969), Feldhausen et al. (1969), Renzulli (1976), Tannebaum (1983), Harrington et al. (1983), and Gallagher (1985).

These studies show that creative thinking is teachable. "Through education and training, the innate creative ability of individuals can be stimulated and nourished." (Rose and Lin, 1984, p. 22).

There are many programs and techniques that can be used in education to enhance creative thinking, among them is the Future Problem Solving Program. For the purposes of this study, the researcher will focus on the Future Problem Solving Program.

4. Applicability of Creative Thinking to the Real World

The lessons learned in training programs for creative thinking such as the FPSP are thought to extend beyond the classroom. Lowenfeld believed that creativity training had real-world applications. He stated that "...acreative child, one who has been encouraged to develop his imagination and ability freely, will bring these qualitites to any work that he does." (Lowenfeld, 1962, p. 10).

E. Paul Torrance, the originator of the FPSP, pointed out that creative thinking had important applications to the real-world. In Developing Creative Thinking Through School Experiences (1962), Torrance stated that creative thinking was needed for: personality development and mental health (since the prolonged, enforced repression of the creative desire may lead to the breakdown of the personality); the acquisition of

information; the application of knowledge to daily personal and professional problems; and the progress of civilization.

A plea for the importance of developing creative potential was made by Guilford in Factors That Aid and Hinder Creativity (1962). He stated that "We must make more complete use of our most precious natural resource -- the intellectual abilities of our people, including their creative potentailities." (Guilford, 1962b, p. 122).

## E. The Osborn-Parnes Model of Creative Problem Solving

Creative Problem Solving (CPS) is a five-step process that was originally introduced by Alex Osborn in his book entitled Applied Imagination (1967). Osborn wrote that the creative process of problem solving usually included all or some of the following phases, though not necessarily in the given order:
1) orientation, 2) preparation, 3) analysis, 4) ideation, 5) incubation, 6) synthesis, and 7) evaluation.
Orientation is the stage that points out the problem. Preparation involves the gathering of pertinent data. This includes what information one knew before and the new information that is researched. Analysis is the breaking down of the relevant material. This helps one to find new facts and discover relationships. Ideation is the piling up of alternatives by ways of ideas.

Considered by Osborn to be the most important phase of creative problem solving, ideation calls for thinking of all possible ideas as tentative solutions or leads to other ideas which might lead to solutions. Incubation is the letting go so that illumination is invited. Synthesis is the phase of putting together the pieces. The opposite of analysis, synthesis is the most fruitful phase since most ideas are combinations or improvements of other ideas. Evaluation is the step where the resultant ideas are judged.

As refined by Sidney J. Parnes, the Creative Problem Solving Process now consists of five steps: 1) fact finding, 2) problem finding, 3) idea finding, 4) solution finding, and 5) acceptance finding (Parnes, 1987). Fact Finding is the preparatory stage of researching and analyzing data. Problem Finding involves the analyzing of problem areas for the purpose of choosing The problem to be addressed. Idea Finding is the production of as many ideas as possible for leads to solutions. Solution Finding is the evaluating of the possible solutions against defined criteria. Acceptance Finding is the developing of a plan to implement the solution chosen.

The Creative Problem Solving process has been adapted by the Future Problem Solving Program. The steps of the process used by the Future Problem Solving Program are: 1) researching the topic, 2) brainstorming problems,

3) identifying the underlying problem, 4) brainstorming solutions, 5) selecting criteria, 6) evaluating solutions, and 7) describing the best solution (Crabbe, 1985a). Anne Crabbe (1985a) compared the two processes of CPS and FPSP:

| In CPS | became | In FPSP |
|---|---|---|
| Fact Finding | -- | Researching the Topic |
| Problem Finding and Identifying the | -- | Brainstorming Problems Underlying Problem |
| Idea Finding | -- | Brainstorming Solutions |
| Solution Finding | -- | Selecting Criteria, Evaluating Solutions, and Describing the Best Solution |

1. Need For Creative Problem Solving

Why do we need to spur creative problem solving? According to Osborn (1967), our ancestors faced hardships in their survival so creative problem solving was naturally induced as they searched for ways to find food, shelter, and the basic necessities of life. In other words, it was a matter of survival. We now have a decline in creative incentive because of easier living conditions and routine jobs. "Many of our most creative people came from immigrant forebears who had long faced starvation or persecution, or both." (Osborn, 1967, p.

186). Subscribing to the philosophy that necessity is the mother of invention, Osborn believed that once the economic pressure is relaxed, one must give oneself the feeling of need. "The best way to become more creative is to practice creativity -- actually to reach out for creative problems..." (Osborn, 1967, p. 198).

Looking at the lack of creative problem solving abilities in individuals, Osborn considered the thinking minds of humans as having two aspects: the judicial part which analyzes, compares, and chooses; and the creative part which visualizes, foresees, and generates ideas. He wrote that in most people, judgement grows with the years while creativity tends to dwindle unless it is actively encouraged. In viewing why this trend occurs, he concluded that circumstances cause people to use their judgement more. People become creatures of habit, develop inhibitions, and "rigidize" their thinking. The problem occurs when new problems are faced and we try to solve them using solutions we have already used for similar problems.

The way to counteract the trend of rigid thinking in creative problem solving is to use "brainstorming" (Osborn, 1967). Osborn used brainstorm sessions (which were originally called organized ideation) for the first time in 1939. Since then, brainstorming has become an integral part of the Creative Education Foundation (which

was formed in 1954 to encourage creativity in American education), and the Creative Problem Solving Institute (which was first held in 1955), a multitude of creative problem solving expressions, and the Future Problem Solving Program.

2. Usefulness of the Osborn-Parnes CPS Model

The Torrance study of 1973 showed that the techniques of the Osborn-Parnes model of creative problem solving was the most effective to teach children to think creatively. More than a decade later, experimental subjects showed an increased ability to solve real-life problems after taking a course in the principles and procedures by Osborn (Parnes, 1987).

In summing up the usefulness of the Osborn-Parnes model, Parnes stated that "CPS uncovers new ways to view, define, and/or approach challenges, desires, problems, or dilemmas to achieve effective, implementable resolutions." (Parnes, 1987, p. 283).

## F. Futuristics

To fully understand the rationale behind the FPSP, it is necessary to investigate the other major component of the program, futuristics, the study of the future, based on the interpretation of present trends.

1. Dangers of Future Shock

There is no doubt that we are living in a rapidly changing world. In his book Future Shock, Alvin Toffler

wrote, "...we have not merely extended the scope and scale of change, we have radically altered its pace." (Toffler, 1970, p. 18). In The Study of the Future, Edward Cornish stated that until the Industrial Revolution, conditions in human history had remained relatively static, especially in the lifetime of an individual. Since the 18th century, the rate of change has radically accelerated. "Change is a process that feeds upon itself. Each change leads to more changes." (Cornish, 1977, p. 4). Now we are at a point where today, "Change seems to be the only constant in our lives." (Cornish, 1977, p. 5). So rapid are the changes that Toffler says that the present time represents the second great divide in human history, comparable to the first great break: the shift from barbarism to civilization.

Draper Kauffman wrote in Futurism and Future Studies (1980), that the second half of the 20th Century is different from any other period of history, especially in four ways. First, there are multiple threats to the survival of humans. Second, there is a sharp increase in the rate of social changes. Third, our society is more complex than at any other time. Fourth, there is a major increase in the need for anticipatory solutions.

How are humans responding to the rapid changes present in modern society? According to Toffler (1970),

humans are being overstimulated with too much change in too short a time. As a result, they are experiencing overwhelming stress and disorientation. Their physical adaptive systems and decision-making processes are being overloaded. Toffler coined a phrase to describe this phenomenon -- future shock -- which first appeared in print in 1965. In The Study of the Future, Cornish suggested that the term future shock might be called "change shock." He wrote that "People no longer feel certain of anything - job, spouse, church, moral principles, or whatever - because everything is changing." (Cornish, 1977, p. 12).

Since technology has radically increased the pace of change, does it mean we are doomed to the maladaptation of our future? No. In his book Future Shock, Toffler not only described the phenomenon and reasons for future shock, he also outlined coping strategies. He stressed that change can be managed if it is anticipated. Future shock can be prevented. "If our children are to adapt more successfully to rapid change...we must sensitize them to the possibilities and probabilities of tomorrow. We must enhance their sense of the future." (Toffler, 1970, p. 375).

2. The Role of Futuristics in Education

Where will this anticipation, this learning about the future take place? Our greatest institute for

passing on knowledge has been based in our schools. As Dwight Allen stated in What the Future of Education Might Be, "The ultimate function of education is to prepare students to be members of our society." (Allen, 1974, p. 4). As our society and its needs change, so must the schools. With industrialization, schools refocused from learning about the past to the present. With the new needs of our fast-paced society, we must look to the future. "It is no longer sufficient for Johnny [and Jane] to understand the past. It is not even enough for him [her] to understand the present, for the here-and-now environment will soon vanish. Johnny [and Jane] must learn to anticipate the directions and rate of change. He [she] must, to put it technically, learn to make repeated, probablistic, increasingly long-range assumptions about the future." (Toffler, 1970, p. 375). In 1979, Stacy and Mitchell also stated that education based only in the past and present no longer provided adequate preparation for life in the future. Today will not be replicated tomorrow. They claimed that students need to become knowledgeable in the pace of change that had grown so rapidly, and in the process of change itself. Many others have criticized education stating that when education is based only in the past and the present, it is not providing adequate preparation for

life in the future (Kauffman, 1980; Jennings & Cornish, 1980; Weber, 1973).

As part of this orientation, besides data acquisition, schools must teach the manipulation of data. In other words, students must "learn how to learn" (Toffler, 1970; Mead in Cornish, 1977). Since we have come to the point in our history where information available to humans doubles every two years, it is possible that data learned while students are in grammar school, may be obsolete by the time they graduate from high school. Awareness of the lack of future-focused curriculum was stated by Weber in Human Potential and the Year 2000, who wrote "A common complaint among young people even remotely concerned with futures is that their schooling, including graduate school, never prepared them for the changes that took place even during the first decade after they left school." (Weber, 1973, p. 150).

How can schools prepare students for a world that doesn't yet exist? Kauffman (1980) states that schools should provide students with better, more sophisticated ways of thinking about the future. Schools need to provide students with the skills and concepts needed to understand complex systems. We must identify and help students understand the major issues that will shape the future. We also need to aid students in their

understanding of change, especially rapid change, and ways to cope with it.

In 1978, the first Regional Conference of the Education Division of the World Future Society was held at the University of Houston, Texas. During this conference it was stated that one of the most effective ways to cope with change was to help create it. Cornish (1977) pointed out that students cannot change the past, but they can change the future.

Torrance, Bruch, and Torrance (1976), were also concerned about the dangers of future shock and how the future can be changed. To help children cope, students can forecast the future by extrapolating from the present trends, since the future starts today. If the consequences they see are not desirable, then they can formulate alternative strategies. They can be part of what makes the future rather than just be passive recipients. That a preferable future can be created and it must begin now was stated by Silvernail (1980).

E. Paul Torrance, the originator of the FPSP stated that "The development of the Future Problem Solving Program has been motivated out of a belief that we have reached a point in civilization at which education must devote a considerable part of the curriculum to helping students enlarge, enrich, and make more accurate their images of the future." (Torrance, 1980, p. 307).

3. Additional Benefits of Future Studies

Not only does studying about the future provide students with a chance to better understand and cope with the future and the changes it may bring, and provide an opportunity to help to make changes for a better future. According to researchers, other, more immediate benefits may result.

"How many students today do not aspire very high because they labor under a present-bound fatalism regarding society's chances for success in the coming years? How many children perform below their natural abilities because they lack a broad, positive set of personal images fof the future? It is clear that increased knowledge of emerging issues can help students to build a more hopeful social outlook, raise their aspirations to meet their real potential, and assume greater command of their lives." (Allen & Plante, 1980, p. 114). "Futurism offers the missing link between education and life." (Cornish, 1977, p. 211).

Allen and Plante in Looking at the Future in Education (1980), said that "Awareness of the future is essential to the development of responsible and ethical behavior." It shows people that there are consequences to their actions. Seeing the impact of long-term consequences and side effects, they develop a greater sensitivity to those around them. A study of the future

also helps them to develop a better understanding of diversity and differences, giving students more of a multi-cultural and multi-racial perspective. Studying the future also helps students to develop more versatile and flexible thinking skills. "...an open view of the future enables students to see ways in which greater personal initiative can make important differences in the outcome of event." (Allen & Plante, 1980, p. 114).

"It is essential that students understand life as the truly complex system of facts and ideas that it is. They must come to value not only specifics but the unity and interrelatedness of those specifics. In establishing priorities and weighing alternatives, they will need an acute awareness of the complexity with which they are dealing and of the repercussions that even a small change can have." (Allen, 1974, p. 8).

4. Gifted Students and the Future

In The Importance of Gifted Students Creating Images of the Future, Sisk wrote, "Preparing gifted students for the future should be a primary effort of schools and educators." "Gifted students who will spend the rest of their lives in the future need to be aware of the major issues in future education such as the environment, the use of technology, and human equity/dignity. Gifted students who may shape the future need to be aware that images shape the future." (Sisk, 1987b, p. 3).

It is very important that gifted students build healthy, positive, creative visions of the future. "Teachers and parents can provide for gifted youth to dream about, plan, and create a better world in the classroom through a futures approach. No less than the survival of our planet may depend on it." (Sisk, 1987b, p.5).

5. Educating for the Future

Steve Benjamin (1989) reviewed 209 documents published between 1974 and 1987 about future trends and reported his findings in An Ideascape for Education: What Futurists Recommend. The purpose of his study was to construct an overview for education in the coming years. He found that global and multicultural pressures will alter the way of life in the United States. Rapid change will continue to be a part of living. Information will become obsolete at an increasing rate. High-level thinking skills as well as the ability to adapt will be needed by workers. Analyzing the data, Benjamin recommended 14 areas for change for the education of all students to prepare them for the future. These are: 1) experiencing active learning, 2) developing higher cognitive skills, 3) using service learning, 4) having a past-present-future focus, 5) seeing learning as life-long, 6) educating for the whole person, 7) coping with diversity, 8) learning a liberal education, 9)

centering on transdisciplinary education, 10) encountering personalized learning, 11) using a process approach, 12) developing interpersonal communication skills, 13) concentrating on early childhood education, and 14) experiencing small structure groupings within the school.

## G. Characteristics Necessary for the Education of the Gifted

Since the FPSP was originally developed for gifted students, the needs of the gifted were analyzed to discover whether the program would be appropriate to this population. In general, in the definition for gifted, the U.S. Office of Education (Maryland, 1972) states:

"Gifted and talented children are those identified by professionally qualified persons who are by virtue of outstanding abilities, are capable of high performance. These are children who require differentiated educational programs and/or services beyond those normally provided by the regular school program in order to realize their contribution to self and society. Children capable of high performance may not have demonstrated it as high achievement, but can have potential in any of the following areas, singly or in combination. 1. general intellectual ability, 2. specific academic aptitude, 3. creative or productive thinking, 4. leadership ability, 5. visual and performing arts, 6. psychomotor ability."

For the purposes of this paper, the gifted will refer to students who have high intellectual ability or the potential to develop this ability. This may be in combination with creative thinking, leadership ability, artistic talents, or physical abilities but does not necessarily include those components.

What characteristics are necessary in activities for educating gifted students? Programs need to be different -- in quality, not quantity (Renzulli, 1979; Sisk, 1987a). More divergent activities are required as is an emphasis on the upper level thinking skills of Bloom's Taxonomy i.e. analysis, synthesis, and evaluation (Renzulli, 1979; Maker, 1982a; Sisk, 1987a). Communication and research skills must be developed (Lawless, 1977; Renzulli, 1979; Sisk, 1987a). Students should deal with real-life topics (Lawless, 1977; Renzulli, 1979). They should also work with aspects of the future (Sisk, 1987b; Torrance, Torrance, & Crabbe, 1983). Creativity within the gifted needs to be unleashed and encouraged (Lawless, 1977; Renzulli, 1979; Sisk, 1987a). Group interaction needs to be developed (Maker, 1982; Barrington, 1979), and access to people in the community, especially experts in a variety of fields, should take place (Renzulli, 1979; Sisk, 1987a). The differences in learning styles among the gifted also needs to be addressed (Renzulli, 1979; Clark, 1979).

Noted for his continuing work in gifted education, Joseph Renzulli (1979), stresses that gifted programs should have qualitative differences in the instructional process. He lists many characteristics that programs for the gifted should have and goals towards which gifted programs should strive. Among these is that gifted students should learn to do research. They must be active rather than passive learners. Renzulli's Enrichment Triad Model has three activities. Type I -- General Exploratory, and Type II -- Group Training, are appropriate for all learners. Type III is especially directed to the gifted. In his Type III Activity -- Individual and Small Group Investigations of Real Problems, he lists three goals. 1) He stresses the need for students to take active parts in formulating problems and the methods to attack the problems. 2) Activites need to be open-ended and not be solvable with a simple yes or no answer. 3) Students must learn to communicate their results in an appropriate manner.

The role of teachers in a Type III Activity includes: 1) assisting students in focusing a general area into a solvable problem, 2) providing students with methodological techniques necessary to solve the problem, and 3) assisting in communicating results to real audiences.

Another expert in gifted education, Dorothy Sisk, discusses principles of a differentiated curriculum developed by the Leadership Training Institute (1987a). These include: 1) presenting content related to broad-based issues, themes, and problems; 2) integrating many disciplines; 3) developing productive, complex, abstract, and higher level thinking skills; 4) focusing on open-ended tasks, 5) developing research skills and methods; 6) integrating basic skills and higher level thinking skills into the curriculum; and 7) encouraging students to develop products that challenge existing ideas and produce new ideas.

Sisk also explains her goals for teaching with a futuristic point of view. They include providing students with better, more sophisticated, more positive ways of thinking about the future. Also, they provide students with skills and concepts necessary to understand complex systems. Futurism helps students identify and understand major issues which help shape the future. It aids students' understanding of change and ways to cope with it. Learning to deal with the future allows gifted students to act on the future rather than to be passive acceptors of what is to come.

Ruth Lawless (1977) in Programs for Gifted/Talented/Creative Children, says that the greatest thing that can be done for gifted children is to help

them feel safe and even welcome when they express new and strange ideas. She discusses the importance of creativity in E. Paul Torrance's steps of fluency, flexibility, originality, and elaboration. She states that ways to challenge gifted children include: involvement with the higher thinking processes, an analysis of values and beliefs, discussion of the conflicts of interests and values, and development of communication skills.

C. June Maker (1982) in her book on Curriculum Development for the Gifted, emphasis in programs for the gifted should be on the use, rather than just the acquisition, of knowledge. This can be accomplished through the use of the higher level thinking skills. Open-endedness in activities is also needed. Students should work with both divergent and convergent tasks. Reasoning should include deductive -- predicting future events or patterns, and inductive -- discovering rules or principles underlying patterns, experiences. Several questions should be asked of gifted students and by gifted students so they have many opportunities to develop their reasoning processes. Group activites are needed to help stimulate leadership potential. Variety is essential to help prevent boredom.

Sandra Kaplan (1974) in Providing Programs for the Gifted and Talented: A Handbook, points out three ways to

differentiate learning for the gifted from the regular curriculum. Working with something new and unusual that is not found in the regular curriculum is called Exposure. Elaboration is giving additional working time, materials, and experiences from the regular curriculum. The third method is called Development and involves a thorough or new explanation of concepts or drills from the regular curriculum.

B. L. Barrington (1979), in "In the Name of Education" from the book New Voices in Counseling the Gifted, lists the following four points among the requirements for gifted and talented programs. 1) Programs should include clear intellectual challenges and have encouragement and recognition for achievement. 2) There should be opportunities for extensive social interaction with peers of similar interests and abilities. 3) There should be contact with adults who are interested in the students' achievement, expect the students to strive for excellence, provide honest feedback about accomplishments, and offer technical information and structure in the learning process. 4) Programs should provide experiences that broaden the students' range of knowledge and also have problem-solving activities that can have meaningful outcomes.

J. P. Torrance, E. P. Torrance, and A. B. Crabbe (1983), in the Handbook For Training Future Problem Solving Teams, express their concern that gifted children frequently lack skills of interdependence. Gifted students must learn to work with their peers of all abilities. Programs for the gifted and talented should include evaluations of team performance and skills in working together -- not just individual performance. Another area that E. Paul & J. Pansy Torrance, and Anne Crabbe see as important to gifted programs is problem solving, especially solving future problems. Besides gifted students' interest in the future, society is dependent upon gifted students for the creation of alternatives in the future, futures in which deliberate choices can be made. Dorothy Sisk (1987), in The Importance of Gifted Students Creating Images of the Future, adds that preparing gifted students for the future should be a primary effort of schools. She says that gifted students need to build healthy, positive, creative visions of the future. The survival of our planet may depend on it.

C.E. Whaley (1987), in Images of Future-Self as Motivational and Behavioral Determinant, also stresses the importance of creative problem solving techniques. He says that the process allows students to find solutions for difficult, multi-layered problems. Gifted

students are also able to explore causality and the linkages of choices which led to the problems. Creative problem solving promotes something very important for citizens of the future -- better planning and decision making.

P. A. Perrone (1983), in Giftedness: A Personal-Social Phenomenon, contends that three characteristics are necessary for gifted programs so intellect will not die. They are: 1) sharing in goal setting where students are active in their learning, 2) increasing task persistence where the students can engage in mastery learning, and 3) divergent activites where students can question and challenge.

Others in the field of gifted education add various points that should be concerns of programs for the gifted. R. Arent (1979), in The Gifted Child and Feelings, says that the gifted should be aware that there is a time and place for acountability and limits. Life has many deadlines and rules that must be followed. They must be prepared for the world of work where flexibility may have its limits. She also says for a healthy emotional adjustment, the gifted must learn how to accept disappointments, defeat, or competition without losing confidence.

M. Dirkes (1983), in Anxiety in the Gifted: Pluses and Minuses, agrees that divergent thinking should be

encouraged. Also a safe atmosphere must be created for the creativity skills of fluency, flexibility, and originality. S. Gerding-Oresic (1987), in It's Not Enough Just to be Gifted, says that it is necessary to develop a high moral sense in the gifted. Two techniques to help accomplish this goal are: 1) to aid students in becoming aware of the consequences of their actions, and 2) to have students focus on desirable futures.

These characteristics are among those deemed necessary to make educational programs appropriate for gifted students.

## H. Review of FPSP Studies

Although there are abundant studies about creative problem solving, very few studies have been undertaken about the Future Problem Solving Program.

In 1985, Mary K. Tallent studied the "Effects of the Future Problem Solving Program on Gifted Students' Abilities to Solve Futuristic Problems." Tallent's study involved 4th and 5th grade gifted students. The experimental group was composed of thirty-three students who had been in the FPSP for at least six months. The twenty-eight controls were non-participants of the program. The method used for the study was a mock FPSP Bowl. Three research questions were considered. 1) What were the effects of the FPSP on the total score of the subjects for an ill-structured problem (fuzzy situation)?

2) What effects did the treatment have on components within each group? 3) Which components of the Future Problem Solving Process differed across groups?

The results indicated that treatment was successful. The subjects who participated in the FPSP had significantly higher total scores than those who had not participated. The treatment and control groups differed significantly by the amount of variance within each group. Significant differences also arose in four out of the six components of the Future Problem Solving Process across groups. Therefore, the conclusion was that the results showed that the goal of the Future Problem Solving Program to help students become better problem solvers was met.

It should be noted that by the nature of this study, these results are limited to the types of problems used in the FPSP. The transferability of FPSP skills to other types of problems is not known at this time. Studies in creative problem solving indicate that students trained in creative problem solving techniques were able to transfer procedures of problem-solving strategies to real-life problems. However, this transferability was greatly enhanced by training in transfer techniques (Cramond, Martin, and Shaw, 1990).

Another study involving the FPSP was finalized in 1984 but involved a different perspective -- the effects

of coaches and time on team scores. Joseph T. Nurek wrote a dissertation entitled "A Comparative Analysis of Selected Personality Characteristics and Time Allocation Trends of Teachers/Coaches in the Michigan Future Problem Solving Program." His subjects were 77 of the eligible 97 teacher/coaches for the regularly scheduled third practice problem of the FPSP.

There were three categories of hypotheses in this investigation: the personality of the FPSP teacher/coach as being directly related to team success; the time allocated by the teacher/coach on Future Problem Solving as directly related to team success; and a combination of the two categories above as being more strongly related to success than either construct alone. Team success was determined by the team's score obtained on the third practice problem of the FPSP in Michigan during the 1982-83 school year. Team data were matched with their teachers/coaches.

The 6 personality scales for the teachers/coaches were taken from the Jackson Personality Inventory. They were: energy level, innovativeness, interpersonal affect, ability to persuade students to achieve certain goals, social participation, and tolerance level. None of the hypotheses above, the time allocation, nor the combination of personality traits and time allocation showed any statistical significance.

The study showed that the investigated personality variables were not found to be a good predictor of team success. The teachers/coaches in the study were found to possess desirable characteristics in all personality traits examined except social participation. Student achievement was not necessarily associated with these characteristics. Time allocation for working with students was moderately related to student achievement with low or moderate ability students gaining greater benefit from time than the higher ability student. Although no statistical significance was found in the factors investigated, some trends were noted in the study. The greatest predictor variable in time allocation was in the amount of time the FPSP teacher/coach spent "working with the students." In other words, the more time the teacher/coach spent working with the students, the more points the team scored in its practice problem.

The best predictor among personality variables was "social adroitness", that is the success of the coach to persuade individuals to achieve particular goals. (This was negatively correlated and only slightly contributed to the variation in team scores.)

The speculation Nurek made for the findings of his study was that perhaps the FPSP attracts teacher/coaches with a particular style of personality.

## I. Summary of the Review of the Literature

In summary, the review of the relevant literature provided the researcher with a greater understanding of the roots of the Future Problem Solving Program: creativity, problem-solving, creative problem solving (especially the Osborn-Parnes Model), and futuristics. Also, information about the needs for educating our population of gifted students and the means of educating all students for the future were acquired.

Through the examination of the research about the effectiveness of the FPSP, the investigator found that very few studies presently exist about the FPSP. Of those studies that have been made, the FPSP has been shown to have a positive impact on the problem solving abilities of the students in a mock FPS Bowl. Personality characteristics of the coaches did not show significant differences on the success of the FPS teams.

The researcher was unable to find any students that investigated whether the objectives of the FPSP were realized in its participants to compare her results.

# CHAPTER III

# METHODOLOGY

The purpose of this chapter is to describe the methodology of the research: identify the population studied; trace the development of the instruments; describe how the instruments were used; and explain how the data were gathered and interpreted.

## A. Topic

The topic for research was an in-depth analysis of the Future ProblemSolving Program, its implementation in the State of Massachusetts, and theattitudes and perceptions of the effects of the FPSP on the program's participants in Massachusetts. A question central to the investigation was did the FPSP fulfill its objectives as reported by the students and adults who participated in the program for the given year?

## B. Sources of Information

The primary sources of information on the impact of the FPSP on the participants in Massachusetts were the actual coaches and students who were involved in the FPSP during the 1988-89 school year. Coaches were the adults who were registered with the FPSP to train students in the FPS process. They included teachers, parents, and school personnel such as a principal and a school psychologist. Coaches involvement in the FPSP may have been required if they were teachers in a program or course that had FPS as part of the curriculum, or

voluntary if the FPSP was an extra curricular activity at their schools or if they were interested parents who chose to coach. There were 106 coaches who registered in Massachusetts for the FPSP during the 1988-89 school year and were potential respondents for this study. Student participants in the FPSP became involved through their schools, either as part of their curriculum or as an extracurricular activity. Approximately one thousand students participated in learning the FPS process through the registered coaches during the 1988-89 school year (as reported by the Massachusetts FPSP State Director Ann Hoyle). Since any number of students can learn the FPS process but only the number of competitive teams must register with the Massachusetts FPSP, a more exact figure is not available.

## C. Population

The first population sampled for this study was the coaches who had registered for the FPSP for the 1988 - '89 school year. Names and addresses of the coaches for the FPSP were obtained from the FPSP State Director, Ann Hoyle. All coaches who registered for the FPSP in Massachusetts during the 1988 - '89 school year were invited to take part in the study. There were 46 coaches who participated in the study out of 106 total possible respondees, for a response rate of 43.40%.

The second population for this study was obtained from the students of the FPSP in Massachusetts during the 1988 - '89 school year. The researcher was able to gain access through the coaches to 678 students. Student participants were contacted through their FPSP coaches. Because of the laws of confidentiality, the names and addresses of students involved in the FPSP were unavailable to the investigator. The FPSP coaches who responded to the initial inquiry distributed the materials for this study to all of their FPS students. The students then had the option whether or not to participate. Of the possible respondees, 513 participated in this study for a response rate of 75.66%.

## D. Instruments

The instruments used for the collection of data were questionnaires specifically developed by the researcher for this study. The first questionnaire, called the "Coach Survey" (see Appendix K), was designed to collect information from FPSP coaches. The second questionnaire, termed the "Student Survey" (see Appendix N), was designed to gather information from the FPSP students from grades 4 through 12. Three types of information were addressed by the surveys for both the coaches and the students: multiple choice, a five-point Likert Scale, and essay questions. The multiple choice questions gathered background information about the participants;

the Likert Scale measured perceived effects of FPS process; and the essay questions requested reactions to the FPSP.

1. Instrument Development

Since no published study has ever been undertaken about how the FPSP is implemented in a state, nor a statewide study of participants on the effects of the FPSP, there were no standardized instruments to use. The researcher therefore designed a questionnaire for use by students and another for use by coaches.

A pilot study was conducted to assess the clarity of the instruments designed for this study. In this pilot study the coach surveys were sent to a sample of three coaches, each representing a different age group: Junior Division - Grades 4 through 6, Intermediate Division - Grades 7 through 9, Senior Division - Grades 10 through 12. Included with the questionnaire was a cover letter asking for any feedback about the survey regarding both content and form. The surveyed coaches were chosen for their wiilingness to constructively criticize and to participate (based on the researcher's past experience with the coaches).

The same procedure was followed for the sample of students n this study. At least one group from each division (Junior, Intermediate, and Senior), was asked to take the sample survey and note any questions or

directions they did not fully understand. Their coaches sent back the completed forms and any comments that the students had made.

The information and criticisms from the coaches and students were gathered and used to modify the content and structure of the original surveys. The Likert scale was changed to a 5-point scale instead of the 3-point scale of the pilot survey. Some of statements in the description of the skills thought to be affected by the FPSP were clarified.

Copies of the revised surveys were sent to Dr. Ron Hambleton of the Research and Development Division, and to Dr. Masha Rudman of the Integrated Day Program, of the School of Education at the University of Massachusetts, for further feedback. A few minor corrections were made and the surveys achieved their final form (See Appendices K and N)

## E. Procedures of the Study

After the pilot study was completed in the spring of 1989, all FPSP coaches who had registered for the FPSP for the 1988-89 school year were contacted by mail. The names and addresses of the coaches were obtained from the Massachusetts FPSP State Director, Ann Hoyle. A cover letter (see Appendix J) explaining the purpose and procedure of the study was sent to all the FPSP coaches with a request for participation in the study of the

coaches themselves and their student problem solvers. A Coach Survey (see Appendix K) to be filled out anonymously was included in the packet. Also enclosed was a return postcard for the coaches who were willing to have their students take part in the study. The information requested on the postcards included the name and address of the coach and the number of Student Surveys to be sent to the coach. Because of the issue of confidentiality, the only way to reach students was through their coaches.

Upon receipt of the returned postcards, packets were sent to the participating coaches with a letter of instruction for the coach (see Appendix L), the requested number of Student Surveys (see Appendix N), instruction sheets for students (see Appendix M), and return envelopes. Because it was important that the participants respond honestly to the questions, all surveys remained anonymous. Each questionnaire was to be returned in a separately sealed envelope so coaches would not see the students' responses.

After the coaches' deadline for returns had passed, the coaches who had not responded to the initial invitation to be part of the study were contacted with a follow-up letter (see Appendix O). The original deadline was extended so coaches (and their students) could still participate in the study.

1. Provisions for Confidentiality

To obtain truthful answers, confidentiality was deemed crucial to the study. Several provisions were made to ensure the anonymity of the respondents and their answers. Explicit instructions were written for both populations (coaches and students) to not include their names with their responses. No questions were asked which could be used to identify which school systems or even which part of the state the responses were from. Since the response envelopes were postmarked from their mailing area, additional precautions were taken to separate the envelopes from the written materials as soon as they were received by the investigator. The researcher also did all the coding of the survey instruments and has been the only person to see the completed forms.

All students and coaches were given their own response envelopes so that no one but the researcher would see their completed materials. Students were also given the option to take their materials home to fill out. Respondents were assured that no direct quotes would be used from the responses.

## F. Data Analysis

The researcher hand scored all data from the instruments. All responses were converted into numeric codes so they could be processed by computer.

Analysis was performed by the Cyber computer at the University of Massachusetts in Amherst, using the Statistical Package for Social Sciences (SPSS-X). The researcher entered the raw data and a consultant programmed the instructions.

Tests performed on the data included the compilation of frequency distribution on all questions, analysis of variance of the Likert responses, factor analysis of the Likert Scale questions and Pearson Product Moment correlation coefficients. All statistical tests were conducted using the .05 level of confidence (p. < 05) for statistical significance.

1. Coding of the Surveys

All data from the coach and student surveys were assigned numeric values (See Appendix P). Multiple choice questions were coded according to the choices made by the respondents to the possible answers.

The responses to the questions in Likert Scale were entered into the computer based on the same 5-point scale that was listed in the questionnaires.

All responses to the essay questions were listed and grouped into categories that emerged from the data (See Appendix Q). Comments that were given at the end of the survey were analyzed by the researcher and assigned a value. They were judged by the investigator to be positive, negative, or neutral (See Appendix R).

To try to capture the overall enthusiasm of the respondees to the FPSP, the researcher assigned a number to the collective responses of each participant (See Appendix S). The possible values were from 1 to 5 with the lowest score representing very negative and the higher score meaning very positive. Judgement was made by the degree of the responses. The use of superlative words such as "greatest" or "most" in a positive comment was given a value of 5. The comparative degree of "better than" or use of "good" led to the assignment of a 4 value. Neutral responses were those that couldn't be judged as positive or negative. Very negative was distinguished by negative by the use of comparative and superlative degrees. In questionable cases, the researcher assigned the lower value. This was done to counteract possible bias by the researcher.

## G. Limitations of the Study

Limitations to be considered are factors that could have influenced both the internal and external validity of the study. For example, without a control group for comparison, the researcher was not able to determine if any of the effects on students' skills were the results of history or maturation instead of involvement in the Future Problem Solving Program. Since there was no previous research identifying the participants in Massachusetts, it was not possible to identify a

"typical" group of Future Problem Solvers. Therefore, a control group to match the experimental group could not be determined.

The original aim of this study was to have a qualitative analysis of the effects of the FPSP and experiences of the participants in Massachusetts. Because of the high response rate of 513 students (75.66%), the researcher added statistical procedures to further manipulate the data to identify possible trends. It would not be possible to to have a control group for both the qualitative and quantitative parts of this study.

Another limitation of the study was that students from a wide range of grade levels were questioned with the same survey. The younger students might have been confused about the meaning of some questions on the survey and could have answered them in different ways. Since participants in the FPSP included students from grades 4 through 12, the researcher found it necessary to include all possible respondents for the study. The same questionnaire had to be used to be able to validly compare responses.

The fact that the surveys were based on opinion and self-report also limited the interpretation of the data. To gather honest appraisals of the FPSP, it was necessary to rely on self-report and opinions of the participants.

External threats to validity could have included a sampling bias. Since the only way to reach the Future Problem Solving students was through their coaches, whether the students had the opportunity to be part of the study depended on the coaches. (Because of the laws of confidentiality, student data such as home addresses were not available to the researcher.) If the coaches didn't want their students to respond, there was no way to include these students in the study.

Experimenter bias could also have been a problem. The way the surveys were presented to the students by their coaches could have affected the way the students responded to them. Also, the interpretation of the data was made by a researcher who is active as a coach in the Future Problem Solving Program in Massachusetts. Extra steps were taken in coding interpretable data to counteract possible bias. Conclusions had to be carefully examined and substantiated.

In order to ensure the confidentiality of the respondents and increase the return rate of the surveys, the researcher made a conscious effort to not request data that could link students to their particular coaches or schools. Because of this decision, certain comparisons and analyses were sacrificed (such as comparing the responses of the students to their own coaches).

# CHAPTER IV

## DATA PRESENTATION AND ANALYSIS

This chapter presents the data from the surveys of the two groups of respondents, namely the Future Problem Solving coaches and the students who were involved in the Future Problem Solving Program (FPSP) in Massachusetts during the 1988 - '89 school year. The questions from the Coaches' and Students' Surveys were grouped, compared (where appropriate) and analyzed.

Background information was charted and discussed. To get an overview of the students who were involved in Future Problem Solving Program in Massachusetts during the year of the study, the number of students who responded to the survey were portrayed according to grade level, gender, and number of years in the Future Problem Solving Program.

The composition of the pool of FPSP coaches in Massachusetts during the same time period was charted according to the their role as coach (parent, teacher, administrator), their gender, the number of years they've coached FPS, and the number and type of students to whom they taught FPS during the given year. The amount of time spent in FPS activities for both students and coaches was also charted and discussed.

The questions from the Likert Scales which portrayed skills thought to be affected by Future Problem Solving, were grouped according to the categories that represented

the objectives of the FPSP: Bloom's Taxonomy, communication skills, creative thinking, futures, research skills, and teamwork. The responses from the coaches were compared to the responses from the students.

The replies to the open-ended essay questions were organized into categories that emerged from the data. The occurrences of each category were noted and discussed.

The gathered data was further analyzed to see if there were specific differences along several variables such as male/female, age levels, time spent per week in the program, and number of years in the program.

## A. FPSP Participants' Responses

The participants of this study were the coaches of the FPSP and the students who learned the FPS process in Massachusetts during the given year.

### 1. Coaches

The coaches were the adults who had registered with the Massachusetts FPSP to teach the FPS process.

#### a. Profile of Coaches

From the experiences that the researcher has had with the FPSP previous to this study, the majority of the coaches from the Western Massachusetts area were female teachers who had been in the program for more than four years. The questionnaire probed the gender, role, and number of years in the FPSP to see whether the population

of Western Massachusetts' FPSP coaches was typical for the entire state.

Thirty-three of the coaches (71.7%) were teachers. Another 19.6% (9) coached as parents of students in the program. The remaining 8.7% (4) coaches were categorized as "other" represented by one parent/principal, one principal, one instructional specialist, and one psychologist. The Western Massachusetts population of FPSP coaches who were teachers was typical of the state.

The majority, 82.6 % (38), were female and 17.4 % (8) were male. This reflects the gender trend of school teachers in Massachusetts.

The number of years that coaches were involved in the FPSP is shown by Table 2 and ranged from one to eight years. The mean for the coaches' activity with FPS was 3.41 years with the largest group (26.1%) reporting their first year of involvement with the FPSP.

Table 2

Number of Years of Coaches in FPSP

| # of Years | # of Coaches | % of Coaches |
|---|---|---|
| 1 | 12 | 26.1 |
| 2 | 6 | 13.0 |
| 3 | 7 | 15.2 |
| 4 | 8 | 17.4 |
| 5 | 5 | 10.9 |
| 6 | 4 | 8.7 |
| 7 | 1 | 2.2 |
| 8 | 3 | 6.5 |

The large number of coaches who were in the FPSP for four years or less contradicted the previous experience of the researcher. The investigator had met with coaches mostly at evaluation sessions and state competitive bowls where more of the experienced coaches were present. The reason is that the FPS process is complicated and new coaches usually hesitate to become involved in evaluations until they have more experience with the process. They are however, invited and encouraged to become evaluators because it helps clarify the process. If coaches understand the FPS process better, they can offer their students a greater chance of success in competitions.

The large number of new coaches correlates to the growth of the FPSP. Some coaches expanded the number of students they worked with for FPS and recruited parents

as additional coaches. Twenty-one coaches (46%) reported being in the program for four or more years.

Of those people who stopped coaching, Ann Hoyle, one of the original coaches, is now the FPSP State Director for Massachusetts. Some coaches have changed careers; others have had their positions eliminated by budget cuts.

b. Impetus For Involvement

Many coaches whom the researcher had met before this study, became involved in the FPSP as a parent of a child in the program. Other coaches "inherited" the FPSP as part of a class or program they were teaching. The literature review showed that the program originally spread by word-of-mouth. The question asking how coaches became involved was in the questionnaire to determine if any of these factors were the dominant methods of introduction to the FPSP in Massachusetts.

All 46 coaches who responded to the survey answered the question of how they became involved with the FPSP. The numbers and categories that emerged through their responses were: eight as parents (17.4%), eight through a conference or workshop (17.4%), six through a principal or administrator (13.0%), six through promotional material (13.0%), five through interest in the program (10.9%), five as part of a class or program they were teaching (10.9%), five through other teachers or coaches

(10.9%), and two through a combination of factors (4.3%). No factor or factors came out dominant as the reasons for coaches to become involved with the FPSP.

The FPSP challenges the resources of the coaches. The process is complicated, frequent deadlines must be met, topics change five times a year and are different every year, and competitions and evaluations take place on Saturdays. Despite this rigorous responsibility, the vast majority (88.9%) of the 45 coaches who responded to the question asking why they stayed with FPS stated that it was because of the gains derived from the program for themselves and/or for their students. A majority of 55.6% responded that they remained in the FPSP because of the advantages for students, 24.4% remained because of benefits for both coaches and students, and 8.9% of the coaches stayed involved for the benefits they received. The gains the coaches reported included such responses as: the power of the process for developing and nurturing thinking skills; the challenge; being able to use the process for life; teaching students teamwork; and exposure to new ideas, places, and experiences.

Informal discussions with other coaches surfaced some frustrations about a lack of support from people around the, especially in a school setting. Some coaches reported that their schools refused to hand out the FPSP awards during school awards' ceremonies. Others

complained that their town newspapers would not give the students publicity when they won an FPS competition. A few teacher/coaches had to fund teams from their school supply money or even from their own salaries. Some coaches had classroom teachers refuse to release students on FPS teams for field trips or guest speakers. Certain classroom teachers complained about students being out of school for international competitions. Other coaches had great success with the support personnel around them. The researcher wanted to gather information from all coaches to determine what the overall level of support was perceived to be from the various sources.

The information found in Table 3 supplies a summary of the FPSP coaches' evaluations of the support they received from classroom teachers, parents, administrators, the community, and the media. A vast majority (91.2%) of the 46 FPS coaches who participated in this study reported parents as providing good to excellent support. Administrators were also considered to be very supportive with 87% of the FPS coaches reporting good to excellent support from them. The community was seen as giving good to excellent support by 67.4% of the coaches. The majority of the coaches (65.2%) reported that classroom teachers gave good to excellent support to the FPSP coaches. Cooperation from

the media was reported from good to excellent by 60.9% of the coaches.

It is interesting to note that no coaches reported poor support from parents and only 6.5% rated parents as giving fair support. Coaches did perceive a lack of support (fair to poor) from the media (32.6%), classroom teachers (28.3%), the community (21.7%), and some administrators (13%).

Table 3

Percents of Coaches' Ratings of
Perceived Support From Various Groups

| | RATINGS | | | | | |
|---|---|---|---|---|---|---|
| GROUP | Exc. | V.Good | Good | Fair | Poor | N |
| Teachers | 17.4% | 21.7% | 26.1% | 19.6% | 8.7% | 43 |
| Parents | 47.7% | 32.6% | 10.9% | 6.5% | 0.0% | 45 |
| Administrators | 41.3% | 28.3% | 17.4% | 8.7% | 4.3% | 46 |
| Community | 26.1% | 21.7% | 19.6% | 13.0% | 8.7% | 41 |
| Media | 8.7% | 26.1% | 26.1% | 10.9% | 21.7% | 43 |

Since the FPSP offers other aspects of the problem-solving process, the researcher asked coaches to indicate whether their students participated in the other types of competitions. Forty-five coaches responded to this question. Ten coaches were involved with Community Problem Solving (22.2%), ten with Scenario Writing (22.2%, and four with Visual Arts (11.1%). Of these, two

of the coaches were registered for all three of these competitions. Four coaches had students registered for two out of three of these competitions, and 13 coaches were registered for only one of these three additional aspects of the FPSP.

One of the exciting parts of participation in the FPSP for the researcher has been a variety of special opportunities that have occurred because of the FPSP. Her professional development was enhanced by presenting a workshop for the FPSP at Harvard and attending training classes given by national directors. The chance to travel to other states arose by accompanying students who were competing at the International FPS Bowls. These are examples of the many special experiences have taken place because of the FPSP. The investigation asked other coaches if they had special opportunities too -- and, what were they like?

Forty-two coaches listed five special opportunities that resulted from their involvement in the FPSP. The five major categories were: FPS competitive bowls (38.1%), a variety of special events such as speaking before the town committee (21.4%), field trips (7.1%), guest speakers (7.1%), and media coverage/recognition (7.1%). The remaining responses (23.8%) named special events such as receiving release time and gaining special opportunities to expand the coach's own horizons.

c. Student Data From Coaches

From meetings with coaches, the researcher had information that some coaches taught FPS only to their competitive teams and other coaches taught FPS techniques to all their students. Was there a "typical" number of students who learned FPS from each coach?

The information in Table 4 illustrates that a great variety existed in the number of students to whom coaches taught FPS. The number of students per coach ranged from four to 80, with the greatest number (representing 15.2%) of five students.

Table 4

Number of Students Per Coach in FPSP

| # of Students | # of Coaches | % of Coaches |
|---|---|---|
| 1 - 5 | 13 | 28.88 |
| 6 - 10 | 8 | 17.77 |
| 11 - 15 | 5 | 11.11 |
| 16 - 20 | 3 | 6.66 |
| 21 - 25 | 6 | 13.33 |
| 26 - 30 | 4 | 8.88 |
| 35 - 40 | 1 | 2.22 |
| 41 - 45 | 0 | 0.00 |
| 46 - 50 | 2 | 4.44 |
| 51...70 | 0 | 0.00 |
| 71 - 75 | 1 | 2.22 |
| 76 - 80 | 2 | 4.44 |

Eighty-seven percent of the coaches taught FPS to up to 30 students which gives the indication that most

students did not learn FPS from a teacher that changed classes and taught FPS to all their students.

The FPSP was originally started as a program for gifted and talented students. The researcher asked the coaches to list the number of g/t students to see if participation in the program in Massachusetts was limited to the gifted.

Five hundred fifty-four of the 864 students taught FPS, were identified as gifted/talented. Four coaches representing 77 students reported that their school systems did not identify gifted/talented students, changing the base number of students to 787. The percentage of gifted/talented students from those possibly designated as g/t was 70.39%, leaving the remaining 29.71% as not identified as gifted/talented.

Because of the amount of work it takes to prepare teams to compete and the added pressures of frequent deadlines, the researcher asked how many teams coaches had registered. The number of teams registered by coaches ranged from one to six (see Table 5). More than half of the coaches (58.7%) reported registering only one competitive team. The next highest percentage (23.9%) reported two teams. The percentages steadily dropped as the number of teams increased, with 10.9% of the coaches reporting three teams, 4.3% four teams, and 2.2% six teams.

Table 5

Number of Competitive FPSP Teams Per Coach

| # of Teams | # of Coaches | % of Coaches |
|---|---|---|
| 1 | 27 | 58.7 |
| 2 | 11 | 23.9 |
| 3 | 5 | 10.9 |
| 4 | 2 | 4.3 |
| 6 | 1 | 2.2 |

Ninety-four percent of the coaches had limited themselves from one to three teams for competition. Another factor to consider here is the cost of registration. Coaches may have been limited to the number of teams by the amount of funding available.

The researcher found through her own experiences that the FPSP gave her chances to provide special opportunities for her students. Did other coaches find the FPSP a vehicle to expose students to other learning experiences?

Forty-five coaches listed special opportunities that their students received through the FPSP. The same categories from the coaches were reported for the students: FPSP competitive bowls (64.4%), special events (24.4%) such as working with the elderly, field trips (13.3%), media coverage/recognition (13.3%), and guest speakers (6.7%). Another 26.7% responses involved a

variety of different opportunities such as gaining pride in self and school through their accomplishments in the FPSP.

d. Time Coaches Spent With FPSP Students

Talking to others at the coaches' meetings at competitive bowls, the researcher learned that there were a variety of places and times that teams met to learn FPS. To gather the data about how prevalent the different meeting times were, the question was included in the survey.

The information in Table 6 illustrates when the FPSP groups met. Nearly half (47.8%) of the coaches reported meeting with their problem solving groups only during the school day with another 17.4% meeting at least partially during school time. Other meeting times reported included after school, evenings, and combinations of times. No coaches reported their groups met on weekends or whenever (which designated no particularly scheduled time).

Table 6

When FPSP Groups Met As Reported by Coaches

| When Groups Met | # of Groups | % of Groups |
|---|---|---|
| During School Only | 22 | 47.8 |
| During School and Other Times | 8 | 17.4 |
| After School Only | 7 | 15.2 |
| Other (Combination of Times) | 6 | 13.0 |
| Evenings | 3 | 6.5 |

The number of hours that coaches met with their teams varied widely. The information in Table 7 illustrates the number of hours that FPSP coaches reported meeting with their teams which ranged from 0.2 to four hours per week with a mean of 1.56 hours. The majority of the teams (32.6%) met for one hour per week.

Table 7

Number of Hours/Week Coaches Met With FPSP Teams

| # Hours/Week | # of Teams | % of Teams |
|---|---|---|
| 0.00 - 1.00 | 20 | 43.48 |
| >1.00 - 2.00 | 21 | 45.65 |
| >2.00 - 3.00 | 3 | 6.52 |
| >3.00 - 4.00 | 2 | 4.35 |

Eighty-nine percent of the coaches reported meeting with their FPSP students for up to 2 hours per week.

Since the coaches may have students in a regular class or program that engages in other activities besides FPS, it was necessary to ask for the time spent on FPS activities. The information in Table 8 displays the meeting times for FPSP activities which were reported by coaches as varying from 0.2 hours for one team to ten hours per week for another team. The greatest percentage of coaches (39.1%) reported that they met with their teams for FPSP activities for one hour per week. The mean of the number of hours that the students met for Future Problem Solving activities was 1.56 hours.

Table 8

Hours/Week Met With Teams for FPS Activities

| # Hours/Week for FPS | # of Teams | % of Teams |
|---|---|---|
| 0.00 - 1.00 | 24 | 52.18 |
| >1.00 - 2.00 | 19 | 41.31 |
| >2.00 - 3.00 | 2 | 4.34 |
| 10.00 | 1 | 2.17 |

Ninety-three percent of the coaches met with their teams for FPS activities for up to two hours.

2. Students

The students in this study were those from grades 4 through 12 who were taught the FPS process by coaches who had registered in the Massachusetts FPSP during the 1988-89 school year.

a. Profile of Students

In the experience of the researcher, most of the schools that taught FPS offered it in elementary grades, some at middle grades, and very few at senior high. The investigator polled the participants to determine if this distribution was true across the state.

Competitive FPS includes grades four through twelve. As demonstrated by Table 9, the majority of the 513 students who responded to this question were from the lower grades with the greatest number in grade five (47.6%). In FPSP terms, the Junior Division (grades 4 - 6), accounted for 71.9% of the students with the Intermediate Division (grades 7 - 9) having 25.0% and the Senior Division (grades 10 -12) supplying 3.1%. The number of FPSP teams registered in Massachusetts for the year of the study 1988-89 was 150. There were 93 teams in the Junior Division (62.0%), 48 teams in the Intermediate Division (32.0%), and 9 teams in the Senior Division (6.0%) (Personal communication with MFPSP Director Ann Hoyle, Feb. 21, 1989). The distribution of respondents was similar to registered FPSP participants

with the greater number of FPSP students found in the lower divisions. The larger percentage of junior level students who responded to the survey compared to the percentage of registered teams at that level is accounted for by the number of younger students who were learning the FPS process but were not registered for competition.

Table 9

Grade Distribution of Students in FPSP

| Grade | # of Students | % of Students |
|---|---|---|
| 4 | 27 | 5.3 |
| 5 | 244 | 47.6 |
| 6 | 98 | 19.1 |
| 7 | 47 | 9.2 |
| 8 | 80 | 15.6 |
| 9 | 1 | 0.2 |
| 10 | 5 | 1.0 |
| 11 | 5 | 1.0 |
| 12 | 6 | 1.2 |

This distribution parallels the greater existence of gifted/talented programs at the elementary level. Also, teachers in self-contained classrooms have greater variability in their schedules than teachers who have their students for only one period a day which happens at the high school level.

A wide variety was seen in the teams that competed at FPSP Bowls. Some teams were composed of all males,

some had all females, some had males and females. The researcher wanted to see if more males or females participated in the FPSP. In an era where it is very important to provide equal opportunities to males and females, were the FPS techniques being taught to mostly one gender? The responses showed that the distribution of the 513 responding students by gender was nearly equal with 50.3% (258) of students being male and 49.7% (255) being female.

b. Participation As Reported By Students

The researcher gathered information to find out how many years students participated in the FPSP. Circumstances showed that each year in the researcher's 7th and 8th grade classes, the students represented a wide variety of experiences from "veteran" FPS'ers who had been in the program for four years to students who were brand new to the FPSP. The number of years that students were involved in the FPSP is shown in Table 10 and ranged from one to six years. Of the 504 who answered this question, the mean for the students' activity with FPS was 1.56 years with the vast majority (70.2%) reporting their first year in the FPSP.

Table 10

Number of Years of Students in FPSP

| # of Years | # of Students | % of Students |
|---|---|---|
| 0 - 1 | 354 | 70.2 |
| >1 - 2 | 64 | 12.7 |
| >2 - 3 | 42 | 8.3 |
| >3 - 4 | 40 | 8.0 |
| >4 - 5 | 2 | 0.4 |
| >5 - 6 | 2 | 0.4 |

The majority of students were in FPS for the first year which indicates growth in the program since the largest number of coaches were also new. It is not possible to tell from this study if the small number of students who have been in the program for more than four years is due to the lack of availability of the program in upper grades or is due to other factors.

Most of the students with whom the researcher had contact previous to this study were involved in the FPSP as part of a regular class or program that they were in. This was substantiated by the study since a majority of students (72.8%) reported that they did learn FPS under these circumstances. Only 6.2% of the students answered that they did not learn FPS as part of a class or program which meant that they met independently of their curricular activities. This question was also included to determine if any advantages would emerge under

statistical analysis in the reported skill acquisition of the two groups.

Student encounters before this study provided information that some students were in the FPS because they had to be (from parents making them participate to FPS being a part of a course they were taking). Other students had stated they they were in the FPSP because they wanted to be. The question asking if participation was by choice was included in the study to find out what percent of students were in each category and to see if the issue of choice made a difference in their perception of skill acquisition.

Of the students who learned FPS, 44.1% responded that they had to learn FPS while 37.7% said they chose to learn the process.

The researcher teaches the FPS techniques to all her students. Because of budget constraints and limitations of time and energy, only a few teams are actually registered for the FPS competitions. Is this situation unique or does this happen to other coaches? Would there be any differences in perceived skill acquisition if the students were on a team or not?

The majority (64.9%) of students who learned FPS process reported that they were on an FPSP team while 31.5% reported learning the techniques but were not on a team. For competitions, FPSP teams consist of four

students. Since larger groups and even entire classes are taught FPSP techniques at the same time, not all students become members of a team. For example, if FPS is part of a curriculum, a social studies class of 25 students may be exposed to the FPS process yet there may be only one or two teams that compete from the class. The number of teams registered is decided by the teacher or school administration, depending on the circumstances of each school. Factors influencing the decision may be budgetary since there is a fee per registered team, or time, energy, or availability of the teacher/coach.

The process of choosing team members is varied and is the decision of individual coaches. For example, some coaches choose their team members through tryouts where students compete to demonstrate who is best qualified. Other coaches use self-selection where class members vote for whom they think will make the best team. Other variations exist but are beyond the focus of this study.

Involvement in the FPSP has provided students of the researcher with an opportunity to have a wide variety of experiences that they would not have had otherwise. The researcher gathered the responses of the students in the study to determine if other students had special experiences.

Of the 513 students who participated in this study, 436 responded to this question. Based on all student participants, the reported special experiences were: FPS competitive bowls (39%), guest speakers (37.6%), field trips (28.4%), media coverage (20.2%), and special events (14.2%). Another 13.1% reported a variety of miscellaneous experiences such as having the school principal teach the class and getting out of their regular classes.

Eighty-five percent (435) of the students reported at least one special event that they attributed to participation in the FPSP.

The information in Table 11 illustrates when FPSP groups met according to 502 students. The majority (81.7%) reported meeting during the school day. Other meeting times included after school, evenings, weekends, whenever they could (meaning no regularly scheduled time), and combinations of times.

Table 11

When FPSP Groups Met As Reported by Students

| When Groups Met | # of Groups | % of Groups |
|---|---|---|
| During School Only | 410 | 81.7 |
| During School and Other Times | 27 | 5.4 |
| After School Only | 33 | 6.6 |
| Other (Combination of Times) | 7 | 1.4 |
| Evenings | 10 | 2.0 |
| Weekends | 1 | 0.2 |
| Whenever | 14 | 2.8 |

The information in Table 12 illustrates the number of hours that 473 students reported meeting with their groups which ranged from less than one to thirty hours per week with a mean of 3.40 hours. This shows that some students were in classes or programs with their teammates which may have included activities that did not involve FPS. Since there was no control group, this factor was included to determine if students would report that any time spent together affected their acquisition of skills or whether they would restrict the impact to time spent in FPS activities.

Table 12

Hours/Week Teams Met As Reported by Students

| # Hours/Week | # of Teams | % of Teams |
|---|---|---|
| 0 - 1 | 96 | 20.3 |
| >1 - 2 | 72 | 15.2 |
| >2 - 3 | 130 | 27.5 |
| >3 - 4 | 72 | 15.2 |
| >4 - 5 | 29 | 6.1 |
| >5 - 6 | 52 | 11.0 |
| >6 - 7 | 5 | 1.0 |
| >7 - 8 | 2 | .4 |
| >8 - 9 | 2 | .4 |
| >9 -10 | 5 | 1.0 |
| 14 | 2 | .4 |
| 18 | 1 | .2 |
| 25 | 1 | .2 |
| 30 | 4 | .8 |

The information in Table 13 displays the meeting times for FPS activities which were reported by 479 students as varying from zero to 14 hours per week. The greatest percentage of students (43.6%) reported that they met with their teams for FPS activities for one hour per week. The mean of the number of hours that the students reported meeting for Future Problem Solving activities was 1.88 hours. FPS activities can be fit into the existing curriculum.

Table 13

Hours/Week Met for FPSP As Reported by Students

| # Hours/Week for FPS | # of Teams | % of Teams |
|---|---|---|
| 0 - 1 | 239 | 49.9 |
| >1 - 2 | 126 | 26.3 |
| >2 - 3 | 59 | 12.3 |
| >3 - 4 | 25 | 5.2 |
| >4 - 5 | 18 | 3.8 |
| >5 - 6 | 1 | 0.2 |
| >6 - 7 | 6 | 1.2 |
| >7 - 8 | 1 | 0.2 |
| >8 - 9 | 1 | 0.2 |
| >9 -10 | 1 | 0.2 |
| 14 | 2 | 0.4 |

## B. Statistical Analysis

Several methods of statistical analyses were used to interpret the collected data.

### 1. Participants' Perceptions of the Impact of the FPSP on Student Skills

The goals of the FPSP are to enhance the following skills in students: creative thinking, teamwork and cooperation, critical thinking, and written and oral communication skills. Another aim of the FPSP is to stimulate students' knowledge and interest in the future. (Mass. Dept. of Ed., 1988). Some of the literature about the FPSP add the development of research skills as an additional objective (Hoomes, 1986; Crabbe, 1985). To determine whether participants thought that training in the FPSP influenced these skills in the students, coaches

and students were asked to address 18 statements reflecting these skills. Responses were made by choosing one out of five possible answers. The choices and their meanings were: 1 = Not At All, 2 = Very Little, 3 = A Little, 4 = Fairly Much, and 5 = A Lot. These choices were to show how much the FPSP coaches and students thought FPS affected the students in the program.

a. Coaches' Perceptions

There were 46 (43.40%) registered coaches in the FPSP who responded to the survey. These coaches were asked to answer 18 sentences indicating how they thought the FPSP affected their students. The skills that the FPSP claims to develop were categorized into six areas using Bloom's Taxonomy, Communication, Creativity, Future, Research Skills, and Teamwork. The means and standard deviations of the responses of the coaches to the perceived skill acquisition of their students are summarized in Table 14.

Table 14

Mean Ratings of Coaches' Perceived Impact of FPSP on Certain Student Skills

| Category | Ques. | Skill | Mean | SD | N |
|---|---|---|---|---|---|
| Bloom's | 17 | Knowledge | 4.435 | .620 | 46 |
| Taxonomy | 23 | Synthesis | 4.130 | .687 | 46 |
| | 13 | Analysis | 4.000 | .699 | 46 |
| | 24 | Evaluation | 3.913 | .661 | 46 |
| Communication | 11 | Oral | 4.196 | .687 | 46 |
| | 10 | Written | 4.067 | .837 | 45 |
| Creativity | 18 | Fluency | 4.261 | .648 | 46 |
| | 19 | Flexibility | 4.065 | .800 | 46 |
| | 20 | Originality | 4.000 | .816 | 46 |
| | 27 | Elaboration | 4.000 | .730 | 46 |
| Future | 16 | I Affect | 4.545 | .761 | 44 |
| | 25 | Complexity | 4.522 | .586 | 46 |
| | 14 | Awareness | 4.326 | .845 | 46 |
| | 15 | Others Affect | 4.326 | .701 | 46 |
| Research | 12 | More Sources | 3.783 | .964 | 46 |
| Teamwork | 22 | Knowing How | 4.457 | .546 | 46 |
| | 21 | Imp. of Others | 4.444 | .693 | 45 |
| | 26 | Deadlines | 4.174 | .769 | 46 |

From Table 14, we can see that coaches were asked four questions that represented components of Bloom's Taxonomy (Bloom, 1956): knowledge, analysis, synthesis, and evaluation. The coaches responded that their students' "knowledge" was most highly enhanced by their involvement in the FPSP (M = 4.435). .By the assigned Likert designations, this places "knowledge" nearly halfway between 4 (fairly much) and 5 (a lot). The higher level thinking skills of "analysis, synthesis, and evaluation," clustered around a mean of 4 (Fairly

Much): synthesis (M = 4.130), analysis (M = 4.000), and evaluation (M = 3.913). The coaches responded that in their opinions, the FPSP influenced the development of critical thinking skills in their students to a rating of 4.120 (fairly much).

Two statements in the survey questioned the impact of FPS on communication skills. The coaches' replies showed that they considered both the oral (M = 4.196) and written (M = 4.196) skills of their students to be developed "fairly much" by their experiences with the FPSP. The average mean for communication was 4.132.

Questions 18-20 and 27 in the survey represented Guilford's creativity skills of fluency, flexibility, originality, and elaboration. Three of the four creativity skills clustered around the mean of 4. (Flexibility M = 4.065, originality M = 4.000, elaboration M = 4.000). The mean for fluency was slightly higher at 4.261. This corresponds with the results of Dufner and Alexander's study comparing the FPSP and the Instrumental Enrichment Programs that showed that the FPSP group scored significantly higher in fluency (Dufner & Alexander, 1987). The coaches reported that they perceived their students' creative thinking skills were "fairly much" influenced by the FPSP experience to the degree of 4.082.

Coaches were asked to respond to four future-related questions (#14 - 16, and 25). The results were that coaches thought that their students: considered that their own actions affected the future (M = 4.545), others' actions affected the future (M = 4.326), had an increased awareness of what it could be like in the future (M = 4.236), and understood that some problems don't have simple answers (M = 4.522). Coaches responded that they thought their students were influenced by the FPSP to 4.430 (more than fairly much) in these areas.

Question 12 asked if students knew more places to look up information because of the FPSP. Coaches responded with M = 3.783 which showed this research skill in students was almost "fairly much" affected by FPS.

Three questions (#21, 22, and 26) asked coaches to respond to the development of teamwork skills in their students. The two elements of "knowing how to work as a team" (M = 4.457) and the "importance of others" (M = 4.444) scored nearly halfway between 4 (Fairly Much) and 5 (A Lot). A lower mean (4.174) was realized by the component of the "importance of completing their work on time." Coaches reported students' teamwork skills as being influenced to 4.358 (more than fairly much) by the FPSP.

Contrasting and comparing the means of the six categories that the questions were divided into, some

interesting observations can be made. The order of the average means of the coaches' responses was (from highest to lowest): Future (4.430), Teamwork (4.358), Communication (4.132), Bloom's Taxonomy (4.120), Creativity (4.082), and Research (3.783). Five out of the six groupings averaged greater than 4 (fairly much). Only research skills averaged less than 4.

b. Students' Perceptions

There were 513 (75.66%) students in the FPSP during the 1988-89 academic year who responded to the survey. These students were asked to respond to 18 questions similar to the questions asked of the coaches. These statements represented the skills that reflect the objectives of the FPSP. The means and standard deviations of the responses of the students to their perceived skill acquisition are summarized in Table 15.

Table 15

Mean Rating of Students' Perceived Impact of FPSP on Certain Skills

| Category | Ques. | Skill | Mean | SD | N |
|---|---|---|---|---|---|
| Bloom's Taxonomy | 21 | Synthesis | 3.865 | .952 | 510 |
| | 22 | Evaluation | 3.762 | .912 | 509 |
| | 11 | Analysis | 3.749 | 1.098 | 506 |
| | 15 | Knowledge | 3.703 | 1.073 | 508 |
| Communication | 9 | Oral | 3.433 | 1.077 | 511 |
| | 8 | Written | 3.301 | 1.062 | 511 |
| Creativity | 18 | Originality | 3.739 | 1.132 | 506 |
| | 25 | Elaboration | 3.702 | .937 | 510 |
| | 17 | Flexibility | 3.616 | 1.075 | 510 |
| | 16 | Fluency | 3.384 | 1.084 | 508 |
| Future | 23 | Complexity | 4.414 | .888 | 510 |
| | 13 | Others Affect | 4.289 | 1.003 | 509 |
| | 12 | Awareness | 3.912 | 1.129 | 510 |
| | 14 | I Affect | 3.820 | 1.354 | 510 |
| Research | 10 | More Sources | 2.709 | 1.336 | 509 |
| Teamwork | 20 | Knowing How | 4.588 | .785 | 510 |
| | 24 | Deadlines | 4.293 | 1.116 | 512 |
| | 19 | Imp. of Others | 4.129 | 1.468 | 506 |

From the information in Table 15, we can see students were asked to respond to four questions representing Bloom's Taxonomy. The three higher level thinking skills of "synthesis" (M = 3.865), "evaluation" (M = 3.762), and "analysis" ((M = 3.749) scored the highest means. The component of "knowledge" scored a mean of 3.703. According to the students, all four represented skills were reported to be affected by the FPSP to an average level of 3.770 (almost fairly much).

Two questions asked for responses about how communication was affected by the FPSP. Both the "oral" (M = 3.433) and "written" (M = 3.301) communication skills scored less that halfway between 3 and 4. The students reported that their communication skills were influenced by the FPSP to a mean rating of 3.367 (a bit more than a little).

Students were asked to respond to four questions addressing the creative thinking skills identified by Guilford (1967). "Originality" scored a mean of 3.739 and "elaboration" scored a mean of 3.702 both showing an impact of almost fairly much. "Flexibility" was reported to be influenced at M = 3.616. "Fluency" scored the lowest with a mean of 3.384. The mean for all creative thinking skills was 3.610 (more than halfway between a little and fairly much).

Four future-related questions (#12-14, and 23) were asked of the students. The highest mean of 4.414, (more than fairly much) in this category was realized by the statement that "some problems don't have simple answers." The three other future-related questions clustered around the choice of 4: "others affect the future" M = 4.289, "better awareness of the future" M = 3.912, and "I affect the future" M = 3.820). The average mean for students' responses for this grouping was 4.109 (fairly much).

Addressing the research section, students reported that the FPSP helped them discover more places to look up information as M = 2.709.

Students were asked three questions addressing teamwork skills. The "importance of knowing how to work as a team" scored a mean of 4.588 (more than halfway between fairly much and a lot). The "importance of doing one's work on time" received a rating of 4.293 with the "importance of other people's ideas" having a mean of 4.129. Teamwork skills were assessed an average mean of 4.337 (more than fairly much).

The six categories of students' responses were represented by their means in order of highest to lowest as: Teamwork (4.337), Future (4.109), Bloom's Taxonomy (3.770), Creativity (3.610), Communication (3.367), and Research (2.709). Students' responses in only two categories (teamwork and future) averaged more than 4. The lowest mean was realized by the research section which scored a mean of less than 3.

c. Comparison of the Means

A summary of the results of the means of the questions relating to the objectives of the FPSP is found in Table 16. Similarities exist between the responses of coaches and students. The categories of future and teamwork ranked the two highest means and scored more than 4 (fairly much) for both coaches and students. The

category of research scored the lowest mean for both populations. The range of reported means for students is greater (from 4.337 to 2.709) than the range of coaches' means (from 4.430 to 3.783).

Table 16

Comparison of Mean Ratings of Coaches and Students on Perceived Impact of FPSP on Student Skills

| Rank Order | Categories for Coaches | Means | Categories for Students | Means |
|---|---|---|---|---|
| 1st | Future | 4.430 | Teamwork | 4.337 |
| 2nd | Teamwork | 4.358 | Future | 4.109 |
| 3rd | Communication | 4.132 | Bloom's Tax. | 3.770 |
| 4th | Bloom's Tax. | 4.120 | Creativity | 3.610 |
| 5th | Creativity | 4.082 | Communication | 3.367 |
| 6th | Research | 3.783 | Research | 2.709 |

Since only one question addressed the category of research, caution must be taken in interpreting the results. However, even comparing single elements, the research skill of knowing more sources to look up information scored the lowest for both coaches and students. This may be due to reliance on the Resource Manual. This book is used by many teams and contains the pertinent terms and definitions of the FPSP topics, overviews of the practice problems, and summaries of readings giving different viewpoints of the topics. If teams do not research beyond the manual, their research

skills don't get a chance to develop. The best teams are forced to do research beyond the manual. Teams that qualify for the International FPS Bowl must do all of their own research since the Resource Manual does not include information about the topic from this level of competition.

d. Comparisons of the Percents of Responses of Coaches and Students

To get an overview of the positive responses (3 = A Little, 4 = Fairly Much, and 5 = A Lot) from coaches and students to the impact of the FPS on ceratin skills, the three positive responses were grouped. The information in Table 17 shows the sums of the percents of positive responses for coaches and students to the questions about the impact of the FPSP on the listed skills.

Table 17

Frequencies of % of Positive Responses (Ratings 3-5) of Coaches and Students to Perceived Acquisition of Certain Skills

| Category | *Coach Ques. | Skill | Total % of Positive Responses (3-5) Coaches | N | Students | N |
|---|---|---|---|---|---|---|
| Bloom's Taxonomy | 17 | Knowledge | 100% | 46 | 85.5% | 498 |
| | 23 | Synthesis | 100% | 46 | 91.5% | 510 |
| | 13 | Analysis | 100% | 46 | 85.2% | 507 |
| | 24 | Evaluation | 100% | 46 | 90.7% | 509 |
| Communication | 11 | Oral | 100% | 46 | 80.7% | 511 |
| | 10 | Written | 95.5% | 45 | 81.1% | 511 |
| Creativity | 18 | Fluency | 100% | 46 | 81.4% | 508 |
| | 19 | Flexibility | 92.6% | 46 | 82.9% | 510 |
| | 20 | Originality | 95.6% | 46 | 84.5% | 505 |
| | 27 | Elaboration | 100% | 46 | 90.6% | 510 |
| Future | 16 | I Affect | 97.8% | 44 | 82.6% | 509 |
| | 25 | Complexity | 100% | 46 | 95.9% | 510 |
| | 14 | Awareness | 97.8% | 46 | 87.1% | 510 |
| | 15 | Others Affect | 100% | 46 | 93.3% | 509 |
| Research | 12 | More Sources | 91.3% | 46 | 51.4% | 509 |
| Teamwork | 22 | Knowing How | 100% | 46 | 96.9% | 510 |
| | 21 | Importance of Others | 97.7% | 45 | 81.9% | 506 |
| | 26 | Deadlines | 97.9% | 46 | 91.0% | 512 |

* The corresponding question on the student survey can be found by subtracting two from the number of the question on the coach survey.

Coaches show a higher percentage of positive responses in all of the questions. The greater probability exists that coaches who were positive about the program would remain as coaches and would respond to the survey.

Some interesting results emerged when the percentages of each response (one to five) of the Likert questions for the coaches and students were graphed and compared. Each of the six categories of questions, namely: Bloom's Taxonomy, communication, creativity, future, research skills and teamwork had a characteristic pattern (See Appendix T). The components within each category had greater similarities in the pattern created by their slopes to each other than to the components of the other categories. The four components of Bloom's Taxonomy had greater similarities among the upper level thinking skills of analysis, synthesis, and evaluation. It is beyond the scope of this study to further analyze these graphs at this time.

2. Factor Analysis

In an attempt to identify common characteristics among the skills that are the objectives of the FPSP, factor analysis was used. Since the questions were originally divided into six categories of responses -- Bloom's Taxonomy, communication, creativity, future, research, and teamwork, it could be predicted that six factors would emerge.

The first run of the responses from the coaches identified one factor which contained all the indicators except for the two reverse questions. The second factor identified only the two reverse questions. To further

discriminate the components, rotated analyses were made. Two factors (accounting for a total of 46% of the variance) were identified from the coaches' replies (see Appendix U). One factor (accounting for 24.1% of the variance) was identified from the students' responses (see Appendix U). The results are discussed in the following sections.

a. Results of Factor Analysis on Coaches' Responses

Two factors resulted from the rotated analysis.

Factor 1: The first factor may be described as details & differences. This factor accounted for 34.4% of the variance. With an eigenvalue of 6.198, it included the following five statements:

10. FPS helps my students to write their thoughts clearly enough for others to understand their meaning.
15. People can make a difference in what will happen in the future.
19. They can give ideas from different categories when they brainstorm.
20. They can give unusual ideas when they brainstorm.
27. They can give details to explain how a solution will work.

These statements represented three out of the six categories of skills. Three questions (19, 20, 27)

represented components of creativity, namely flexibility, originality, and elaboration. One question (10) reflected written communication and the remaining question (15) came from the category of future. These statements show the interrelationship component of students being able to make an impact on the world.

Factor 2: The second factor included five statements. The factor can be described as importance & newness. This factor had an eigenvalue of 2.083 and accounted for 11.6% of the variance. The statements identified were:

14. FPS gives them a better idea of what it could be like in the future.
20. They can give unusual ideas when they brainstorm.
22. They think that it is important to know how to work as a team.
23. They can think of new ideas when they learn new material.
24. Given a number of facts, they can decide what is important.

Of these five statements, two represented upper level thinking skills of Bloom's Taxonomy, namely synthesis (23) and evaluation (24). The remaining three sentences depicted the three categories of future (14), creativity (20), and teamwork (22). The creativity

component was originality. These are all qualities of deep thinking: to create something new, put new elements together, and make decisions about importance.

b. Results of Factor Analysis on Students' Responses

Using the responses of the students to the questions regarding the perceived effects of the FPSP on certain skills to perform a rotated analysis, one main factor was identified (See Appendix U).

Factor 1: The strongest factor identified had an eigenvalue 4.339 and accounted for 24.1% of the variance. This factor can be described as acquiring and communicating facts. Five statements were found in this factor.

8. FPS helps me to write my ideas clearly enough for others to know what I mean.
9. I can tell my thoughts to others so they can understand what I mean.
10. I know more places to look up information because of FPS.
11. I can pick out the facts I need from what I read.
22. Given a number of facts, I can decide what is important.

Of the five statements listed above, two skills of communication - oral (9) and written (10) were included. Two components of Bloom's Taxonomy also appeared -

analysis (11) and evaluation (22). The remaining question (10), represented the research category. The responses of the students indicate that in FPS they see a connection between gaining and communicating information.

Some interesting observations can be made about the next two, though much weaker, factors. With an eigenvalue of 1.581, the second factor was heavily weighed by creativity. It included all four components of creativity (fluency, flexibilty, originality, and elaboration), and the knowledge section of Bloom's Taxonomy. Students responses link creativity with knowledge about problems in the world.

The third factor had an eigenvalue of 1.383. This factor was weighed by the category of future with the appearance of three of the four future components: "FPS gives me a better idea of what it could be like in the future," "People can make a difference in what happens in the future," and "I understand that some problems don't have simple answers." The teamwork skill of the "importance of doing one's work on time" was also included for a total of four questions.

c. Summary of Factor Analysis

In reality, the components of the six categories in which all 18 questions were grouped, do not exist exclusively from each other, but actually intermix to

varying degrees. For example, in Chap. II the researcher discussed the interaction of creativity and critical thinking skills (the upper levels of Bloom's Taxonomy represent critical thinking skills). Communication skills can interact with teamwork since the clarity of shared ideas can determine how well a group works as a team. Another example would be how the ability to make judgements (evaluate) can help a person decide his/her possible impact on the future. Therefore it is not surprising that the original categories did not emerge completely intact.

3. Pearson Product-Moment Correlations

Pearson product-moment correlations were taken to determine if any of the demographic information gathered from coaches and students showed any statistically significant relationships with the reported impact of FPS on the acquisition of student skills. No major differences were found but the correlations that showed a statistical significance of $p < .05$ are presented in the following sections.

a. Statistically Significant Correlations of Coaches' Demographics and the Perceived Impact of the FPSP on Certain Student Skills

Positive relationships (of significance <.05 or less) were found linking the number of hours per week that coaches reported their teams met and four statements (See Table 18). The greater the number of

hours their teams met, the higher the coaches indicated that: the students knew more places to look up information (r = .3668); students were able to draw out the facts they needed from what they read (r = 3423); students could give ideas from different categories when they brainstormed (r = .2608); and students could give details to explain how a solution would work (r = .3080). These components were linked to the time students had to work on these skills whether or not FPS activities were involved.

Table 18

Statistically Significant Correlations of Coaches' Responses to Number of Hrs/Wk Teams Met and Impact of FPS on Student Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 12 | Research | Know More Sources | .3668 | .006 |
| 13 | Bloom's Tax. | Analysis | .3423 | .010 |
| 19 | Creativity | Flexibility | .2608 | .040 |
| 27 | Creativity | Elaboration | .3080 | .019 |

The coaches' responses regarding the number of hours per week their teams met for FPS activities significantly correlated in the positive direction with the reported acquisition of student skills in five statements (see Table 19). Three of the questions showed an increase as

the number of weekly FPS hours increased were upper level thinking skills of Bloom's Taxonomy: students could draw out the facts from what they read (r = .3367); students could think of new ideas when they learned new material (r = .2830); and students could decide what is important when they were given a number of facts (r = .2696). One question related each to creativity -- students could give details to explain how a solution will work (r = .3593), and communicaton -- students were able to verbally express their ideas to others in an understandable way (r = .2771). Coaches noted that the time spent in FPS activites was helpful to students in these areas.

Table 19

Statistically Significant Correlations of Coaches' Responses to Hrs/Wk Teams Met for FPS Activities and FPS Impact on Student Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 11 | Communication | Oral | .2771 | .031 |
| 13 | Bloom's Tax. | Analysis | .3367 | .011 |
| 23 | Bloom's Tax. | Synthesis | .2830 | .028 |
| 24 | Bloom's Tax. | Evaluation | .2696 | .035 |
| 27 | Creativity | Elaboration | .3593 | .007 |

The more students that the coaches had to teach, the lower was the reported impact of FPS on six skills (see Table 20). Coaches reported a decrease in both oral and written communication skills: students are able to write their thoughts clearly (r = -.2919); and students are able to verbally express their ideas in an understandable way (r= -.3131). The results for the categories of research, Bloom's Taxonomy, teamwork, and creativity indicated a decrease in one component each as the number of students increased. These statements were: students know more places to look up information (r = -.3007); students can think of new ideas when they learn new material (r = -.2994); students think that completing their work on time is important (r = -.4781); and students can give details to explain how a solution will work (r = -.4225). These results imply that coaches give less individualized attention to students when they have more students to work with.

Table 20

Statistically Significant Correlations of Coaches' Responses to Number of Students in FPS and FPS Impact on Student Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 10 | Communication | Written | -.2919 | .027 |
| 11 | Communication | Oral | -.3131 | .018 |
| 12 | Research | Know More Sources | -.3007 | .022 |
| 23 | Bloom's Tax. | Synthesis | -.2994 | .023 |
| 26 | Teamwork | Importance of Doing Work on Time | -.4781 | .001 |
| 27 | Creativity | Elaboration | -.4225 | .002 |

Only one correlation was found between the number of students coaches identified as gifted and talented and the reported acquisition of skills. The impact of FPS on students being able to orally express themselves to others in an understandable way decreased with the number of students who were gifted/talented (r = -.2799) (See Table 21). Gifted students may have a problem with their thoughts racing faster than their mouths. Also, they may have difficulty with impatience when other students don't understand them.

Table 21

Statistically Significant Correlations of Coaches' Responses to the Number of G/T Students and FPS Impact on Student Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 11 | Communication | Oral | -.2799 | .031 |

b. Statistically Significant Correlations of Students' Demographics and the Perceived Impact of FPS on Certain Skills

Students' data showed significant correlations between their grade level and seven statements (see Table 22). Five questions were positively related and showed an increase in the reported impact as the grade level increased. Each of the categories of communication, future, Bloom's Taxonomy, creativity, and teamwork had one component reported in the positive direction: I can write ideas clearly enough for others to know what is meant (r =.0732); what I do affects the future (r =.1051); I know about problems in the world (r =.1057); I can think of many ideas in a short time (r =.0800); and other people's ideas are important (r =.1252). Two questions, both from teamwork, were negatively related showing a decrease in the mean as the grade level increased: it is important to know how to work as a team

(r = -.1058), and doing my work on time is important (r = -.1852).

The younger students (those from the lower grades) may have shown a higher mean for the importance of knowing how to work as a team than the older students because the FPS process is very complicated and younger students may have to rely on each other more to help them through the process. This reliance on each other may also account for their considering the importance of doing their work on time (so they can carry their share of the work).

Table 22

Statistically Significant Correlations of Students' Grades and Impact of FPS on Their Acquisition of Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communicaton | Written | .0732 | .049 |
| 14 | Future | What I Do Affects It | .1051 | .009 |
| 15 | Bloom's Tax. | Knowledge | .1057 | .009 |
| 16 | Creativity | Fluency | .0800 | .036 |
| 19 | Teamwork | Importance of Others | .1252 | .002 |
| 20 | Teamwork | Importance of Knowing How | -.1058 | .008 |
| 24 | Teamwork | Imp. of Work Done on Time | -.1852 | .000 |

The responses of five questions from the students showed significant relationships to the number of years students spent in the FPSP and their reported skills. A positive correlation was realized in three of the students' questions representing communication, creativity, and teamwork: being able to write clearly enough for others to know the meaning ($r = .1300$); giving unusual ideas when brainstorming ($r = .0944$); and realizing the importance of others' ideas ($r = .0885$). A negative relationship was seen in two questions from teamwork: the importance of knowing how to work as a team ($r = -.0770$); and doing the work on time is important ($r = -.0748$).

The greater reliance on each other with the less time that a student has been in FPS seems to agree with the speculation that because the process is so complicated, students rely on each other more when they are learning the process.

Table 23

Statistically Significant Correlations of Students' Number of Yrs in FPS and the Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communication | Written | .1300 | .002 |
| 18 | Creativity | Originality | .0944 | .018 |
| 19 | Teamwork | Importance of Others | .0885 | .024 |
| 20 | Teamwork | Importance of Knowing How | -.0770 | .043 |
| 24 | Teamwork | Imp. of Work Done on Time | -.0748 | .047 |

The students' responses to the number of hours the teams met in a week showed significant correlations to four of the questions (see Table 24). A positive correlation resulted to the question of students realizing the importance of other people's ideas (r = .1219). In other words, students' appreciation of the ideas of others increases in proportion to their time spent together. Negative correlations were realized in three questions: people making a difference in what will happen in the world (r = -.1181); thinking of many ideas in a short time (r = -.1033); and deciding what is important given a number of facts (r = -.1018). Just

spending time together negatively affected three out of the six objectives of the FPSP.

Table 24

Statistically Significant Correlations of Students' Number of Hrs/Wk Met and Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 13 | Future | People Make a Difference | -.1181 | .005 |
| 16 | Creativity | Fluency | -.1033 | .013 |
| 19 | Teamwork | Importance of Others | .1219 | .004 |
| 22 | Bloom's Tax. | Evaluation | -.1018 | .014 |

The responses to three of the students' questions resulted in positive correlations with the number of hours students reported spending in FPS activities (see Table 25). The questions were from communication -- writing ideas clearly enough for others to understand (r = 0855); and two were from creativity -- thinking of many ideas in a short time (r = 0783); and giving details to explain how a solution will work (r = 1223). Spending time in FPS activities had a statistically significant positive impact on the FPS objectives of clarity in communication and increased creativity.

Table 25

Statistically Significant Correlations of Students' Number of Hrs/Week Met in FPS Activities and Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communication | Written | .0855 | .031 |
| 16 | Creativity | Fluency | .0783 | .044 |
| 25 | Creativity | Elaboration | .1223 | .004 |

The students' responses to four questions showed a positive statistically significant correlation to learning the FPSP as part of the curriculum (see Table 26). The four questions were: writing my ideas clearly enough for others to understand (r = .0792); the importance of other people's ideas (r = .1472); the importance of knowing how to work as a team (r = .0760); and understanding that some problems don't have simple answers (r = .1230).

Table 26

Statistically Significant Correlations of Students' Learning FPS As a Curricular Activity and Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communication | Written | .0792 | .037 |
| 19 | Teamwork | Importance of Others | .1472 | .000 |
| 20 | Teamwork | Importance of Knowing How | .0760 | .043 |
| 23 | Future | Complexity of Answers | .1230 | .003 |

The correlations in Table 27 show that the students' responses to eight questions realized significances of <.05 to learning FPS as a co-curricular activity (which means that FPS is not learned as part of a class or program). Seven questions showed positive relationships: all four components of creativity, two from Bloom's Taxonomy, and one each from communication and teamwork. The statements were: writing clearly enough for others to understand (r = .1321); picking out needed facts from what is read (r = .0890); knowing about problems in the world (r = .0945); thinking about many ideas in a short time (r = .1475); giving ideas from different categories when brainstorming (r = .1076); giving unusual ideas when brainstorming (r = .0958); and giving details to explain how a solution will work (r = .1515). A negative

correlation was realized by the responses to the importance of getting their work done on time (r = -.1113). FPS had a greater impact on the four components of creativity when FPS was learned under a less-structured atmosphere. Perhaps the importance of accomplishing one's work on time was reported lower because the time restrictions of each meeting would be less confining than when one is in a particular class or program that is assigned a specific amount of time.

Table 27

Statistically Significant Correlations of Students' Learning FPS As a Co-Curricular Activity and Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communication | Written | .1321 | .001 |
| 11 | Bloom's Tax. | Analysis | .0890 | .023 |
| 15 | Bloom's Tax. | Knowledge | .0945 | .017 |
| 16 | Creativity | Fluency | .1475 | .000 |
| 17 | Creativity | Flexibility | .1076 | .008 |
| 18 | Creativity | Originality | .0958 | .016 |
| 24 | Teamwork | Imp. of Work Done On Time | -.1113 | .006 |
| 25 | Creativity | Elaboration | .1515 | .000 |

The students' responses to 12 of the 18 questions about their skills showed a positive and significant correlation with the students choosing to learn FPS (see Table 28). The questions included all four components

representing Bloom's Taxonomy, three of the four from creativity, two from teamwork, and one each from communication and research. The statements were: writing ideas clearly (r = .1996); knowing more places to look up information (r = .1247); picking out facts from what is read (r = .1893); believing that I affect the future (r = .0985); knowing about the problems in the world (r = .1441); thinking of many ideas in a short time (r = .1997); giving ideas from different categories when brainstorming (r = 1562); believing in the importance of others (r = .1171); the importance of knowing how to work as a team (r = .1127); thinking of new ideas when learning new material (r = .0987); deciding what is important given a number of facts (r = .1693); and giving details to explain how a solution will work (r = .1805).

Table 28

Statistically Significant Correlations of Students' Learning FPS By Choice and Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communication | Written | .1996 | .000 |
| 10 | Research | Know More Sources | .1247 | .002 |
| 11 | Bloom's Tax. | Analysis | .1893 | .000 |
| 14 | Future | What I Do Affects It | .0985 | .013 |
| 15 | Bloom's Tax. | Knowledge | .1441 | .001 |
| 16 | Creativity | Fluency | .1997 | .000 |
| 17 | Creativity | Flexibility | .1562 | .000 |
| 19 | Teamwork | Importance of Others | .1171 | .004 |
| 20 | Teamwork | Importance of Knowing How | .1127 | .005 |
| 21 | Bloom's Tax. | Synthesis | .0987 | .013 |
| 22 | Bloom's Tax. | Evaluation | .1693 | .000 |
| 25 | Creativity | Elaboration | .1805 | .000 |

The students' responses to being on a FPS team showed positive and significant correlations with all but two of the students' questions relating to their skills (see Table 29). The only two questions that didn't show positive relationships to a significant degree were: knowing more places to look up information; and doing their work on time is important. The competitive aspects or more individualized attention of being on a FPS team show powerful implications for FPSers.

Table 29

Statistically Significant Correlations of Students' Being on a FPS Team and Impact of FPS on Certain Skills

| Ques. | Category | Skill | Correlation (r) | Significance (p) |
|---|---|---|---|---|
| 8 | Communication | Written | .2386 | .000 |
| 9 | Communication | Oral | .0954 | .016 |
| 11 | Bloom's Tax. | Analysis | .1139 | .005 |
| 12 | Future | Better Awareness | .1178 | .004 |
| 13 | Future | People Make a Difference | .0818 | .033 |
| 14 | Future | What I Do Affects It | .1372 | .001 |
| 15 | Bloom's Tax. | Knowledge | .0824 | .032 |
| 16 | Creativity | Fluency | .1485 | .000 |
| 17 | Creativity | Flexibility | .0804 | .035 |
| 18 | Creativity | Originality | .0946 | .017 |
| 19 | Teamwork | Importance of Others | .0866 | .026 |
| 20 | Teamwork | Importance of Knowing How | .1296 | .002 |
| 21 | Bloom's Tax. | Synthesis | .0782 | .039 |
| 22 | Bloom's Tax. | Evaluation | .1186 | .004 |
| 23 | Future | Complexity of Answers | .1420 | .001 |
| 25 | Creativity | Elaboration | .1815 | .000 |

4. T-Tests

T-tests were run on several demographic factors and the reported means of students' responses to the impact of the FPSP on certain skills. The means were very close in value so no tremendous differences were found. The statistically significant ($p < .05$) results are reported in the following sections.

Five questions showed a statistically significant difference in means between the responses from the male students and the female students (see Table 30). The questions which all showed a higher significant mean for female students were: what I do affects the future (14); I know about problems in the world (15); I can think of many ideas in a short time (16); I understand that some problems don't have simple answers (23); and doing my work on time is important (24). They indicate a slight edge for females in the categories of future (14 & 25), Bloom's Taxonomy (15), creativity (16), and teamwork (26).

Table 30

Statistically Significant T-Test by Students' Gender Reporting Certain Skills Acquired Through FPSP

| Ques. | Gender | N | Mean | SD | T Value | Degrees of Freedom | 2-Tail Prob. |
|---|---|---|---|---|---|---|---|
| 14 | Male | 257 | 3.6965 | 1.439 | 2.07 | 507 | .029 |
| | Female | 252 | 3.9444 | 1.255 | | | |
| 15 | Male | 254 | 3.6260 | 1.158 | 1.56 | 505 | .007 |
| | Female | 253 | 3.7747 | .976 | | | |
| 16 | Male | 255 | 3.3451 | 1.163 | .87 | 505 | .015 |
| | Female | 252 | 3.4286 | .997 | | | |
| 23 | Male | 256 | 4.3359 | .994 | 2.01 | 507 | .032 |
| | Female | 253 | 4.4941 | .824 | | | |
| 24 | Male | 257 | 4.1518 | 1.230 | 2.87 | 509 | .000 |
| | Female | 254 | 4.4331 | .971 | | | |

The results in Table 31 show the statistically significant differences in the grade level of the students and their reported means on certain skills. Since the greatest number of students in the study represented the Junior Division of Future Problem Solving (grades 4 - 6), these grades were placed in one grouping and all other grades (7 - 12) were placed in the second grouping. Three questions showed significant differences in the means. Two questions had greater means for group 2 (grades 7 - 12): I can give unusual ideas when I brainstorm (18) and other people's ideas are important (19). Creativity and teamwork report a slight edge in the responses of the older students. One question, namely, I understand that some problems don't have simple answers (23), had a greater mean for group 1 (grades 4 - 6). This may be due to students being exposed for the first time to complex, open-ended issues and discussion with a variety of possibilities. (Younger students may see the world from their own perspective until they hear other viewpoints.)

Table 31

Statistically Significant T-Test by Students'Grade Level Reporting Certain Skills Acquired Through FPSP

| Ques. | Grade | N | Mean | SD | T Value | Degrees of Freedom | 2-Tail Prob. |
|---|---|---|---|---|---|---|---|
| 18 | 4-6 | 362 | 3.7072 | 1.178 | 1.01 | 504 | .031 |
| | 7-12 | 144 | 3.8194 | 1.008 | | | |
| 19 | 4-6 | 363 | 4.0055 | 1.568 | 3.03 | 504 | .000 |
| | 7-12 | 143 | 4.4406 | 1.124 | | | |
| 23 | 4-6 | 367 | 4.4169 | .928 | .13 | 508 | .017 |
| | 7-12 | 143 | 4.4056 | .780 | | | |

The information in Table 32 shows the statistically significant differences in the number of years students reported being in FPS and the degree their skills were influenced by FPS. Since the majority of students (354) reported the year of the study to be their first year in the FPSP, group 1 consisted of students in the FPSP from 0 - 1 year. Group 2 consisted of all students that were in FPSP for more than one year. A total of four questions showed significant differences. Three showed greater means for students who had been in FPS for more than one year: I can give unusual ideas when I brainstorm (18); other people's ideas are important (19); and I understand that some problems don't have simple answers (23). Creativity, teamwork, and future categories showed a slight edge in one component each for

the students who had been in the FPSP for more than one year. One question, people can make a difference in what will happen in the future (13) had a higher means for those students in the FPSP for less than one year. Students new to the FPSP may be feeling the sense of being able to change the world for the first time. Students in the program for longer times may have come to realize that the issues are very complex.

Table 32

Statistically Significant T-Test by Students' Number of Years in FPS Reporting Certain Skills Acquired Through FPSP

| Ques. | Years in FPS | N | Mean | SD | T Value | Degrees of Freedom | 2-Tail Prob. |
|---|---|---|---|---|---|---|---|
| 13 | 0-1 | 350 | 4.3000 | .957 | .54 | 498 | .033 |
| | > 1 | 150 | 4.2467 | 1.105 | | | |
| 18 | 0-1 | 348 | 3.6695 | 1.177 | 2.38 | 495 | .042 |
| | > 1 | 149 | 3.9329 | 1.018 | | | |
| 19 | 0-1 | 350 | 4.0400 | 1.521 | 2.08 | 496 | .040 |
| | > 1 | 148 | 4.3378 | 1.312 | | | |
| 23 | 0-1 | 352 | 4.3892 | .930 | .69 | 499 | .036 |
| | > 1 | 149 | 4.4497 | .801 | | | |

The information in Table 33 shows the statistically significant differences in the number of hours per week that students reported meeting and the means of

students' skills. Students reported from less than one to 30 hours of meeting per week. The groupings were divided into zero to five hours per week and more than five hours per week. Question 19 -- other people's ideas are important, showed a higher means for those students who spent more than five hours in meeting per week. Question 20 -- it is important to know how to work as a team, showed a slightly higher mean for students who spent from zero to five hours meeting per week. The less time they spend together per week, the less time they have as a team, the more they may need each other.

Table 33

Statistically Significant T-Test by Students' Number of Hrs/Wk Met Reporting Certain Skills Acquired Through FPSP

| Ques. | Hrs/Wk Met | N | Mean | SD | T Value | Degrees of Freedom | 2-Tail Prob. |
|---|---|---|---|---|---|---|---|
| 19 | 0-5 | 391 | 3.9693 | 1.552 | 3.90 | 462 | .000 |
| | > 5 | 73 | 4.6986 | .861 | | | |
| 20 | 0-5 | 394 | 4.5863 | .764 | .85 | 466 | .003 |
| | > 5 | 74 | 4.5000 | .983 | | | |

Two questions showed a statistically significant difference in the hours per week students met for FPS and the means of their skills (see Table 34). Grouping 1

consisted of the responses of students who met from zero to five hours per week for FPS activities. Grouping 2 consisted of the responses of the rest of the students (who met from 5 to 14 hours per week). The higher means was realized for both questions by the group that met for more than 5 hours per week for FPS activities: I understand that some problems don't have simple answers (23) and doing my work on time is important (24). The more time spent in FPSP activities helps students increase a component of teamwork and awareness of the future.

Table 34

Statistically Significant T-Test by Students' Number of Hrs/Wk in FPS Reporting Certain Skills Acquired Through FPSP

| Ques. | Hrs/Wk in FPS | N | Mean | SD | T Value | Degrees of Freedom | 2-Tail Prob. |
|---|---|---|---|---|---|---|---|
| 23 | 0-5 | 461 | 4.3861 | .910 | 1.70 | 471 | .003 |
| | > 5 | 12 | 4.8333 | .389 | | | |
| 24 | 0-5 | 463 | 4.2916 | 1.122 | 1.15 | 473 | .004 |
| | > 5 | 12 | 4.6667 | .492 | | | |

The information in Table 35 shows the significant differences of the means of when students reported meeting and the reported means of their skills. The

responses were grouped according to whether they met during school (all or in part) or they did not meet during school hours. One question (18) -- I can give unusual ideas when I brainstorm showed significance in the means with the students who did not meet during school reporting a higher means. Since schools have a more structured atmosphere students have some difficulty being creative within these confines.

Table 35

Statistically Significant T-Test by When Students Reported Meeting and Certain Skills Acquired Through FPSP

| Ques. | When Met | N | Mean | SD | T Value | Degrees of Freedom | 2-Tail Prob. |
|---|---|---|---|---|---|---|---|
| 18 | During School | 431 | 3.7007 | 1.158 | 1.77 | 493 | .045 |
| | Not During School | 64 | 3.9688 | .942 | | | |

## C. Evaluative Reflections of Participants

Coaches and students were asked to respond to several essay questions to help the researcher gain an insight into their opinions and reactions to the Future Problem Solving Program.

1. Coaches

The FPSP is complex and challenging to teach. Since coaches must become familiar with the topics to teach them effectively, the researcher asked for the coaches opinions of having to learn different topics each year. Of the 45 coaches who gave their reactions to this question, a large majority, 88.9%, responded that they were in agreement with it. Two coaches (4.4%) reported disliking having different topics each year and three coaches (6.7%) chose the neutral response.

Coaches were asked to list any factors they considered to be strengths of the FPSP. Based on the 45 coaches who answered this question, they listed strengths as: the critical thinking/FPS process (62.2%), teamwork/group effort (51.1%), creativity (26.7%), and having real topics affecting the students (24.4%). A variety of responses (48.9%) were also reported including comments such as having dedicated teachers/coaches/evaluators.

In order to determine if there were any inherent faults in the FPSP, coaches were asked to list weaknesses. Forty-four coaches responded to this query. The weaknesses they thought applied to the FPSP were: problems with time such as deadlines and meeting after school (27.3%); the difficulty of the FPS process (18.2%); evaluation problems such as negative comments or

subjectivity (13.6%); and a lack of funding (11.4%). The coaches also pointed out a miscellaneous group of weaknesses such as a lack of recognition for FPS as an educational program and not having more senior level teams.

Problems involving a lack of time to complete the process or make the deadlines are reported as a weakness by the greatest number of coaches.

To see if there were any areas that coaches saw that could be improved in the FPSP, they were asked to list suggestions. Thirty-three coaches responded to this question. The main issues involved: time requirements (30.3%) such as increasing the amount of time between deadlines; having regional FPS bowls (24.2%); offering more training for FPS (18.2%); funding (9.1%) so more students could participate; the topics (9.1%) such as having students select them, and evaluation/feedback such as giving more comments to students (3%). The miscellaneous answers that were given (21.2%) included such statements as getting more publicity.

To gather responses that may not have fit into any of the questions or may have been foremost in their minds, coaches were given instructions to freely add any comments. Only 14 coaches made additional comments about the FPSP or their involvement in the program. Of these 14, 12 were judged to be positive comments about the

FPSP, such as wishing they could teach more of FPS in their schedules and 2 were judged to be negative, such as having an entry to the competition returned without any comments.

To get an overall impression of the coaches towards the FPSP, the researcher made a judgement of the responses to the essay questions of each coach. For the 46 coaches that responded to the essay questions of the survey, the enthusiasm of their responses were judged by the researcher as: very negative (2.2%), negative (2.2%), neutral (13.0%), positive (56.5%), and very positive (26.1%). Judgement was made on the basis of coaches' use of words representing degrees. For example, superlatives such as "worst" were considered as "very negative." The use of words such as "best, excellent, or great" were judged as being "very positive." (See Appendix S).

2. Students

Students were also given a chance to respond to several essay questions. Because the possible variations of responses were unknown, the essays were left open-ended and the responses were grouped.

A wide variety of reasons why they liked the FPSP were given to the researcher by the students she had taught. She included this question to see if there were particular reasons that showed up across the state.

A total of 476 students listed what they liked about the FPSP. Of all 513 student participants in the study, responses were: teamwork (22.5%), the FPS competitive bowls and the opportunities they bring (18.9%), the knowledge gained through FPS (17.2%), learning about the future (17.2%), creativity (17%), thinking skills (14.5%), making a difference in the world (13.9%), and communication skills (13.2%). Miscellaneous responses were added by 23.9% of the students and included such answers as students appreciating being given more responsibility, having a feeling of accomplishment, and recognition being given to smart kids. Several likes emerged rather than one dominant response.

The researcher has had students who did not like the FPSP. The students were asked to list their dislikes to see if any trend occurred. A group of 460 students answered what they disliked about the FPSP. The responses indicated that: 23% disliked the time involved, such as when they met or how much time they put into FPS; 21.3% were not happy with the amount of work FPS takes; 16.1% did not like the difficulty of the process; 13% wrote that they thought FPS was boring, and 10.9% indicated problems with social issues such as the members on the team not getting along. Another 25% listed a variety of other dislikes such as coaches "being picky," not having enough field trips, waiting a long time for

results, and the pressure involved. Time and the amount of work in the FPSP came out as the top dislikes.

Four hundred and forty-two students gave suggestions for improving the FPSP. The main issues listed for improving the FPSP were: use better topics (11.3%) (during the year of this study, the topics were not student selected); make the FPS process easier (10.6%); time -- such as giving more time to research each topic or giving more than 2 hours to complete the packet (10%); expand the program to more teams, more schools, or more students (7.9%); have more opportunities such as field trips or guest speakers (6.1%); social issues such as letting students choose their own teammates (5.2%); and 3.2% suggested that the program should be eliminated. Miscellaneous ideas were listed by 26% of the students. Some of these suggestions included sending the students' solutions to the government so they could be implemented, raising money so more students could participate, and giving trophies to each member of the team instead of one trophy per team.

To give the students the chance to add anything else that was on their minds about the FPSP, they were given the opportunity to answer what else they would like to say about the FPSP, or about their experiences with it. There were 353 additional comments made by the students.

The comments were judged by the researcher to be distributed as: positive (65.1%), negative (21%), and neutral (13.9%) (See Appendix R for sample comments).

Of the 513 possible respondees, 485 students filled out the essay section of the questionnaires. The responses were weighed by the researcher as: very negative (3.7%), negative (14.6%), neutral (26.8%), positive (48.7%), and very positive (6.2%). The values were assigned the same way as the coaches responses with the use superlatives such as "worst" given the value of "very negative" and "best, excellent, or great" given a very positive. Students' use of "good" and "better" were considered "positive" with "bad" considered "negative" (See Appendix S). The purpose of these judgements was so that the researcher could get an overall picture of the enthusiasm of the respondents to the FPSP.

# CHAPTER V

## CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

The purpose of this study was to describe the Future Problem Solving Program (FPSP), gather information about how the program was implemented in Massachusetts, and discover what impact the program had on its participants. Forty-six coaches and 513 students from grades 4-12, who were involved in the FPSP in Massachusetts for the 1988-89 school year, participated in this study. Information was gathered through questionnaires and the responses were analyzed. Responses to the seven questions raised in Chapter I were addressed.

Further analysis was made to determine whether there were specific differences along a variety of variables such as a difference in the perception of communications skill enhancement caused by FPS between males and females, or the different age groups.

This chapter will summarize the description, implementation, and involvement and will present conclusions about the program's impact.

### A. Summary (See Appendix V for Tables)

The information from the responses of the participants are summarized in the following sections.

#### 1. Description

The FPSP was originally started in Georgia as a school-based program and in Massachusetts continued to be implemented solely through the schools. Many factors

contributed to this practice and are reviewed in the following sections.

a. Participants

The majority (33) of the coaches in the FPSP in Massachusetts during the 1988-89 school year were teachers. Nine adults coached FPSP teams as parents. Following the typical gender distribution of teachers in schools from grades 4 through 12, the greater number of coaches were female (38).

The FPSP had a nearly equal gender distribution among students with 258 males and 255 females responding to the survey. Coaches reported that 70.39% of the students to whom they taught FPS techniques were identified as gifted/talented (g/t). Although the FPSP was originally intended for g/t students, in Massachusetts it is also taught to other segments of the student population.

The largest student population responded from grade 5 (244 students). The greatest number of students who responded by level represented the Junior Division (366 students from gr. 4-6). The next highest group represented the Intermediate Division (128 students from gr.7-9) with Seniors (gr. 10-12) reporting only 16 students. This distribution is similar to the number of registered teams. Time and availability of the program are factors contributing to the decline in FPSP

participants among high school students.

b. Implementation of the FPSP Program

The FPSP is implemented in a variety of ways in schools across the state. The majority of coaches (22) and students (410) reported that they met with their FPS groups only during school hours. Seven coaches and 33 students reported that their FPSP group met after school. Variations existed in implementation since 11 students reported meeting on evenings and weekends and 3 coaches reported evening meetings. A regularly scheduled time was most common.

Time was another variation found in the way the FPSP was implemented. Twenty coaches reported that they met with their FPS groups for up to one hour per week and 21 said they met for between 1 and 2 hours. The largest group of students (130) responded that they met for between 2 and 3 hours per week with the next largest population of students reported meeting up to one hour per week. It is not necessary that the FPSP take a large chunk of time out of a curriculum to be taught.

It is not possible to tell from the data how many coaches regularly teach FPS in their classes as part of the curriculum. However, since some coaches reported teaching 50 or more (up to 80) students, the likelihood exists that at least some coaches do implement FPS as part of their classroom curriculum (The greatest number

of teams that any coach reported was 6). This indicates that these coaches see the potential for the FPSP to be beneficial for all of their students, not just a restricted section of their student population.

c. Involvement in the FPSP

Twenty-seven of the coaches responded that they only had one registered team for competitive FPS. Eleven had two teams, 5 had three teams, 2 had four teams, and 1 coach reported having six competitive teams. The reason(s) for the different number of teams cannot be determined by this study but trends indicate time and/or energy limitations of the coaches and the funding available to register teams.

Nearly one fourth of the coaches reported that this was their first year in the FPSP. With 46% of the coaches participating in the FPSP for four or more years, there isn't a large turnover. Although the FPSP has been available in Massachusetts since 1979, the greatest number of years any coach reported spending in FPS was 8 years. One of the original coaches is State Director for Massachusetts. It is not known how many coaches have changed careers or have had their jobs eliminated due to budget cuts.

The range for the number of years that students were in the FPSP went from 1 to 6 years with the vast majority (354) reporting their first year in the FPSP. This,

together with the high number of coaches in the FPSP for the first year indicates growth in the number of students learning FPS in Massachusetts.

There were several different methods for coaches to become involved in the FPSP. No one factor was dominant. The factors listed were: as parents of FPS students, through conferences or workshops, through a principal or administrator, through promotional materials, through interest in the program, as part of a class or program they were teaching, or through other teachers or coaches. The implications are that a variety of efforts (such as publicity and encouragement of existing coaches) should be supported if growth of the program is to continue.

Forty of the coaches responded that they stayed in the FPSP because of the gains they received from the program for their students and/or themselves. Even though the program is challenging (and sometimes taxing) for coaches, they report that the value of the program outweighs the work.

The support coaches perceived receiving from various groups was high. Parents were found to be the most supportive, with administrators, the community, classroom teachers, and media following in order. The smaller percentage of coaches that responded with positive support from classroom teachers compared to some of the

other groups may be due to the implementation of the FPSP as a pull-out program in some schools. If classroom teachers knew more about the type of work that students did in the FPSP they might be more supportive of the coaches and students. In-service workshops would prove helpful in this area.

Coaches reported that their students were involved in other aspects of the FPSP. Ten coaches reported participation in Community Problem Solving, ten had students in Scenario Writing, and five had students in Visual Arts. Coaches valued the program enough to give their students a chance to try to use different aspects of their talents. Community Problem Solving gives students a chance to apply their creative problem-solving skills to a real-life, present-day problem in their town. Scenario writing gives students an opportunity to develop their writing skills while concentrating on how the future may be. Visual arts, when it was available in Massachusetts, gave students a chance to use their artistic talents to create a visual representation of the problems.

2. Reactions of the Participants

One of the purposes of this study was to gather the reactions of the participants to the FPSP: their special experiences because of their participation, the strengths

and weaknesses they perceived about the program, and their suggestions for improvement for the FPSP.

The responses of coaches and students to the question asking them to list the special experiences they could attribute to their participation in the FPSP fell into the same categories: FPSP competitive bowls, special events, guest speakers, field trips, and media coverage. Participation in FPSP bowls was the event experienced by the most coaches and students. Ninety-one percent of the coaches and 85% of the students listed at least one special experience they could attribute to the FPSP. This information demonstrates that the FPSP is a vehicle for coaches and students to go beyond the curriculum and get involved with the world outside of their classrooms.

Coaches listed the strengths of the FPSP as developing critical thinking skills in students through the FPS process, encouraging teamwork and group effort, increasing creativity, and providing real topics affecting the students.

The major responses of students to their likes about the FPSP were: being able to work as a team, participating in the bowls and the opportunities they brought, gained knowledge about the world and its problems, learning about the future, using creative thinking, developing thinking skills, making a

difference in the world, and increasing communication skills.

The coaches listed weaknesses in the FPSP as: time commitments, difficulty of the process, evaluation problems, and the lack of funding. The students listed their dislikes about the FPSP also as time commitments and the difficulty of the process. Students also included problems with social issues such as having team members who did not "pull their weight." A few students responded that FPS was boring.

Both coaches and students were given the opportunity to make suggestions to improve the FPSP. The dominant issues for coaches were: increasing the time, having regional bowls (which has since been instituted), offering more training, funding, student-selected topics (which has been reinstituted), and a more consistent evaluation process. Since this study, evaluations take place at a common site so there is more consistency. (The evaluators all receive the same instructions and questions are answered by the evaluation coordinators as they arise.)

The suggestions that students gave were: using better topics, make the FPS process easier, give more time to complete the requirements, expand the program, have more opportunities such as guest speakers. Social

issues also arose with some students wanting to choose their own teammates.

The majority of the additional comments given by the participants in the FPSP were positive with coaches having 85.7% of their responses and students having 65.1% of their comments judged positive.

The enthusiasm towards the FPSP was gleaned by the researcher from an overview of the essay responses from each respondent. The total of positive and very positive replies were 81.6% from coaches and 54.9% from students. The majority of both populations of respondents showed enthusiasm and positive reactions to the FPSP and their involvement in it.

3. Impact of the FPSP on Its Participants

One of the purposes of this study was to gather information about the extent that the FPSP developed certain skills of the students (as perceived by the coaches and the students).

a. Reported Effects of FPSP on Students' Skills

Coaches reported that five of the six groupings: Bloom's Taxonomy (representing the upper level thinking skills), communication, creativity, future, and teamwork were all positively affected by the students' involvement in the FPSP. The only skill that scored lower than 4 (meaning FPS "fairly much" influenced that particular skill) in its mean from the coaches was research skills.

Even though only one question was asked in this category, the research skill of "knowing more sources to look up information" scored the lowest for both coaches and students. Since this may be due to reliance on the Resource Manual, coaches should be encouraged to allow students to do some of their own research. If the International FPS Executive Board is interested in increasing research skills, they could include more ideas for sources for each topic.

Although overall the means of the students' responses to skill acquisition were slightly lower than the means reported by the coaches' data, only research had a mean lower than 3 (meaning slightly less than "a little"). The categories of "teamwork" and "future" showed the highest impact (more than fairly much) from the FPSP from coaches and students. Coaches and students reported that they perceived positive effects of the FPSP on the skills that were addressed. Overall, the results showed that the participants reported that the FPSP does have a positive impact on the skills in question. Since the categories were from the goals of the FPSP, this indicates that the FPSP fulfills its goals in the participants in Massachusetts to a positive extent with more work needed in the development of research skills. It must be noted that all responses were self-reported

and no control existed for this study with which the population could be compared.

b. Additional Variables

Several additional variables were investigated. The means were very close and the correlations were low so no major issues emerged. A few interesting trends were noted. The statistically significant correlations are discussed in the following section.

i. From Coaches' Responses. "Time" indicated a slight advantage on four of the 18 skills with the greater the number of hours that teams met showing an increase in the means for the flexibility and elaboration of components of "creativity," in analysis from "Bloom's Taxonomy," and knowing more sources to look up information from "research." The more time that could be devoted to these activities, the better they could develop.

"Time" also emerged as an advantage with five of the 18 skills scoring higher means for the increase in time spent in FPSP activities. The longer the teams met specifically for FPS activities, the higher "Bloom's" upper level thinking skills of synthesis, analysis, and evaluation were reported. Also oral communication and the elaboration component of "creativity" were positively affected by the greater number of hours spent in FPS activities.

Coaches reported negative correlations in two areas. When the number of students increased, five skills decreased: the written and oral "communication" skills, the "research" skill of knowing more sources, synthesis of "Bloom's Taxonomy", the elaboration component of "creativity," and the importance of doing one's work on time from "teamwork." The more students per coach, the less time coaches could devote to individuals. With more students available to do the given work, students appear to put less emphasis on their own contributions.

An interesting point emerged from the data with oral communication showing a negative relationship to the number of students that were identified as gifted/talented. This may be due to the difficulty some gifted students have with their minds racing ahead of their ability to speak.

ii. From Students' Responses. Some factors showed only statistically significant positive correlations for the students: meeting for longer periods for FPS activities, meeting during school as a class or program, learning FPS by choice, and being on an FPS team. Other factors gave combinations of positive and negative correlations: the grade of the students, the number of years in FPS, meeting for longer times per week, and learning FPS outside of the school class or program (See Appendix V). The trends are noted as follows.

Participation on an FPS team was the strongest factor. It showed the largest number of correlations with 16 out of the 18 skills positively correlated with statistical significance.

The next strongest factor was the impact of learning FPS by choice. Twelve out of the 18 skills were positive and had statistical significance.

When FPS was not learned in a class or program, seven out of 18 components reported higher means. Four of these were from the category of "creativity." Less-structured atmospheres encourage creativity. Coaches may need to increase efforts to promote creativity within the confines of a class or program. The disadvantage of not learning FPS in a class or program was shown in the decrease in believing in the importance of doing one's work on time. More structure appears to be beneficial to increasing the sense of responsibility.

Learning FPS in a class or program encouraged stronger "teamwork" skills through the components of the importance of others' ideas and the importance of knowing how to work as a team. This situation also encouraged the "future" component of understanding the complexity of some problems.

Meeting for longer times for FPSP activities showed advantages for developing fluency and flexibility of

"creativity" and written "communication." The increase in number of years in FPS encouraged originality and written "communication" but discouraged the report on two "teamwork" components. The increase in grade showed a positive correlation with one component in every category except "research." The same two "teamwork" components were reported lower. Older students seemed to show less reliance on "teamwork."

From another perspective, the categories (objectives) of the FPSP were affected as discussed in the following section.

Written "communication" was reported by students to be positively affected by seven out of the eight factors. Oral "communication" was increased by students being on a team. The FPSP does help students to communicate clearly.

The category of "creativity" showed positive statistically significant correlations for all four of its components. Fluency was affected by five of the eight factors; flexibility -- three factors; originality -- three factors; and elaboration -- four factors. FPS does encourage creative thinking. The only significant negative correlation in "creativity" was found in fluency which decreased as the number of hours per week increased. Just spending time together actually had a negative impact on fluency.

The four components of "Bloom's Taxonomy" exhibited statistically significant positive correlations. Knowledge was affected by four factors; analysis -- three factors; synthesis -- two factors; and evaluation -- two factors. Evaluation had a negative correlation with the number of hours per week. Critical thinking skills as represented by Bloom's Taxonomy can be increased through the FPSP.

The "future" category had four components. Two of these showed statistically significant positive correlations with one factor, one with two factors, and one statement with three factors. A negative correlation with number of hours per week was realized by the statement "People can make a difference in the world," showing the lack of impact on the "futures" objective of the FPSP if students are just spending time together. The FPSP does stimulate students' knowledge of the future.

The objective of "research" was affected by only one factor, the choice of learning FPS. Perhaps students are more likely to give extra effort when they feel they have some control over the situation.

"Teamwork" was represented by three statements. "Others' ideas are important" was positively affected by five factors. "It is important to know how to work as a team" had positive correlations with three factors and

negative correlations with the grade and the number of years in FPS. The older students and more experienced FPSP students have a better understanding of the process and do not have to rely as heavily on other teammates to use the correct structure. If they are working independently at times within the team (such as dividing the work during FPSP competitions to finish within the given time), they may not report this as a team effort. Therefore, the FPSP does promote teamwork, especially since this was one of the top two categories reported by the means of coaches and students.

Interestingly, "It is important to do my work on time," showed only negative correlations that were statistically significant. The factors were grade, number of years in FPS, being on a team, and not learning FPS in a class or program. The first three factors represent students that are more experienced. Since they are trained to react spontaneously to a given situation, they may feel more confident in their immediate responses (especially if they are gifted/talented).

The results of the T-tests showed interesting trends. The factors that realized statistical significance are discussed in the next section.

When the factor of students' gender was isolated, females showed an advantage. Five out of 18 questions showed significant differences with a higher mean for

females: what I do affects the future, I know about problems in the world, I can think of many ideas in a short time, I understand that some problems don't have simple answers, and doing my work on time is important. This may be due to the high number of students (72%) who were in grades 4-6 since females show higher academic achievement in these grades.

Dividing the responses by grade level, three significant differences resulted. Older students (gr. 7 -12) reported greater originality and appreciation of others' ideas. Grades 4 through 6 showed a higher mean for understanding that some problems don't have simple answers. This may be due to the newness of younger students being exposed to several different, and often varying, viewpoints.

Higher means were demonstrated for students who were in the FPSP for more than one year in three components. Experienced students reported greater originality, an appreciation of other people's ideas, and understanding that some problems don't have simple answers. The new FPSP students realized (possibly for the first time) that people can make a difference in what happens in the world.

For the students who spent more than five hours per week in FPS activities, they showed greater understanding

that some problems don't have simple answers and the importance of doing their work on time.

The time students spent together showed some significance. Dividing the number of hours that teams met into groupings of up to and including five hours, and more than five hours, two results were significant: an appreciation of other people's ideas was greater for those that met for longer periods of time, and the importance of knowing how to work as a team was greater for those students that met for less time per week. Having less time together, they rely more on each other.

The only component that was significantly affected by whether students met during school or not during school, was originality with students reporting a higher mean for the students that did not meet during the structured time of the school day.

## B. Conclusions

Many conclusions can be reached from the investigation of the data received from the participants.

### 1. Summary of Responses

The Future Problem Solving Program in Massachusetts offered equal opportunity for participation for male and female students. Females reported a slight advantage in the skills gained through FPS. The program was available in grades four through twelve. The greatest number of students participated in the upper elementary

grades (4 - 6), especially grade five. Grades 7 - 9 had the next highest number of participants. The lowest number were from high school (gr. 9 - 12). It is suspected that this is at least partially due to the limited availability of the FPSP in the higher grades. The majority of FPSP students in Massachusetts were identified as academically gifted but participation was not limited to this population.

FPSP was implemented in schools throughout Massachusetts in a wide variety of ways. Learning FPS in a class or program showed a slight advantage in teamwork and creativity. Not learning FPS in a structured atmosphere (such as part of a class or program) showed greater creativity but less teamwork. The older students showed less reliance on teamwork skills, perhaps due to increased experience in the FPS process and confidence in their own abilities.

Coaches taught FPS to a variety of class sizes. Some concentrated their efforts on one team (five or less students) while others taught FPS to all their students (up to 80). The majority reported spending 2 hours or less per week on activities related to FPS. Teaching FPSP techniques can be adjusted to the circumstances of individual schools.

The FPSP was a vehicle for increased opportunities for both coaches and students. It provided chances for

students to extend their learning beyond the classroom and was a way to get parents and communities involved with the schools.

Though challenging to learn and teach, the majority of participants reported that the benefits of learning the process outweighed any difficulties encountered. Most of the coaches and students demonstrated enthusiasm about the FPSP and their participation in it. Responses show that the FPSP has positive impact on the six objectives of the program: encouragement of creative thinking, stimulation of knowledge of the future, promotion of teamwork, development of critical thinking skills, clarity in oral and written communication, and development of research skills. Coaches reported a positive effect on all six categories (objectives). Students responded a positive impact on five of the six categories -- all but research. Research showed the lowest impact by coaches and students. The two highest objectives for both populations were the development of teamwork skills and increased knowledge of the future.

Although statistical significance ($p < .05$) was reached in several factors, correlations were low and means were close. A few trends emerged. The factor showing the greatest positive impact was membership of students on a FPSP team. The next strongest impact was learning FPS by choice.

The FPSP did fulfill its goals in the participants in Massachusetts. The program has shown it is worthwhile as an educational program. It had many positive results on the participants with surrounding personnel (in school and out). Besides being appropriate for the gifted, it helped teach skills important to all students through creative problem solving and futuristics. Its implementation can be adjusted to the individual circumstances and resources of schools. The FPSP should remain in schools in Massachusetts.

2. Recommendations

Since the majority of the coaches were inexperienced, additional guidance should be given to help them learn the process and avoid pitfalls such as feeling overwhelmed. Support literature is available but more personal contact could prove helpful.

More publicity is needed for the program. Teachers could have in-service workshops to explain the process to their colleagues. This could help school personnel understand the importance and challenge of what their students are doing. The media should be involved on an expanded basis to give encouragement to the efforts of the FPSers.

FPS programs should be extended into the upper grades so students can continue the enforcement and

development of the valuable FPS skills and knowledge of important, real-world topics.

Less reliance should be put on the Resource Manual or more suggestions for further research (especially different types) should be included. Special opportunities such as guest speakers should be expanded.

Funding should be pursued to help continue the program in schools that are financially burdened. More teams should be considered for schools that offer the program. The program should be expanded to other schools.

More research should be promoted to gauge the impact of the FPSP on the school, on the community, and on the applicability of FPS skills to students' lives.

### C. Recommendations For Further Research

Now that the initial, investigative study about the Future Problem Solving Program in Massachusetts has been completed, several other components could be isolated and researched. Some of these could include looking at the differences in skill attainment attributed to the FPSP between teams that are self-selected rather than teacher-selected or if the students receive a grade for the work they do in FPS compared to those that do not get graded. Another area to investigate might be to see if research skills are better developed in teams that do not use the Research Manual compared to those who do use the

manual. Perhaps a combination of supplementing the manual with more active explorations would best develop research skills.

Other possible studies might be to investigate the comparison of skill attainment of the gifted participants compared to those who have not been identified as gifted, or competititors compared to those who have not competed in FPSP bowls, or students who learn FPS in smaller classes compared to larger classes.

Another factor for further study is the reason(s) that coaches had for the number of teams or students to whom they taught FPS. Did the available time or energy level of the coaches, or amount of existing funding affect the number of registered teams? Also, since the availability of the program seems to drop in the upper grades, would students have stayed in the program if they had the opportunity? How many coaches chose to teach FPS? Did this have the same effect on their responses that it did for students?

Although male and female students have equal opportunity to participate in FPS, do they have equal accessibility to be on a competitive team? Is there a predominant gender on competitive teams at various grade levels?

Another question to be pursued could be the transferability of skills of the participants. Does FPS

affect the grades of the students? Do students see any advantages of having learned FPS techniques for other school subjects or circumstances (such as college or other aspects of their lives)?

For those who are more interested in formal quantitative explorations, a study could be undertaken with a control group and an experimental group to eliminate possible threats to the validity of the study due to maturation or history. A pretest-posttest study might give a better indication of the skill level of students rather than relying on self-report.

Qualitative studies could be undertaken through interviews of coaches, parents, teachers, and students.

The long-range implications of training in the FPS process could also be investigated. Do students retain the skills they develop? How long do they retain the skills after their participation in the FPSP ends?

Parallel studies could be done in other states to compare results of the Massachusetts study. A follow-up study could be done in Massachusetts to gage the impact of the budget cuts on the FPSP since the year of this study (1988). How many teacher/coaches lost jobs due to budget cuts? Are more parents coaching to fill in the gaps? Are the students staying in the program for the same number of years? Has the availability of the FPSP changed in their schools? An additional question could

include where the funding is coming from to register teams. If schools have changed to teaming and/or mainstreaming, has the new academic structure affected the FPSP? If so, how?

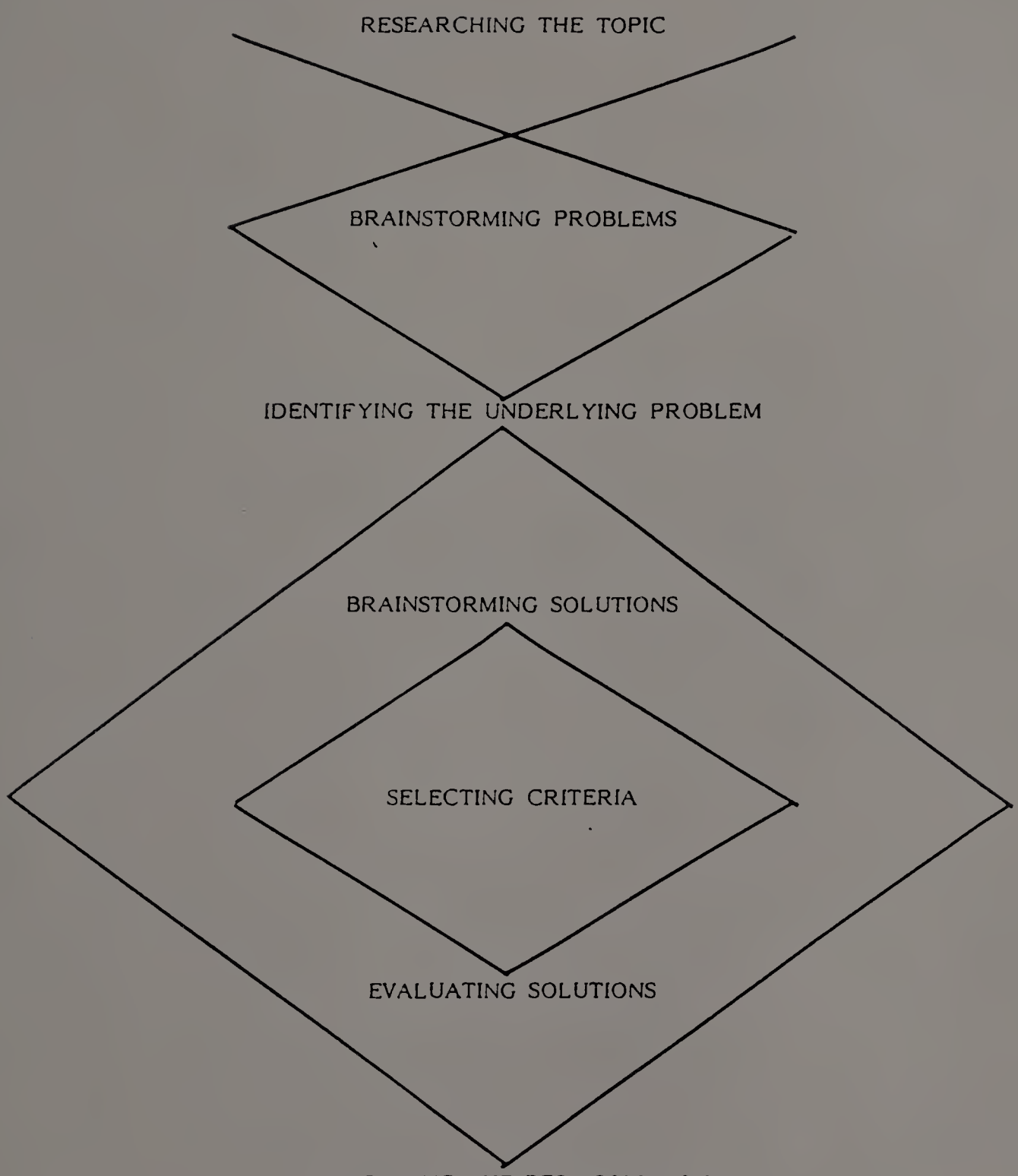
Areas for recommendation for further investigation emerged from the search of the literature. The definition for creativity is still elusive. The nature vs. nurture controversy of creative potential in each individual still needs to be conclusively researched. Also, what are the needs of students not identified as gifted compared to the needs of gifted students? What are the criteria for selecting and identifying gifted students? What effects does the elimination of tracking have for gifted students?

The other aspects of the FPSP, namely, Community Problem Solving, Individual Problem Solving, Scenario Writing, and Solution Selling also warrant inquiry to gage what benefits they offer to their participants.

There are many possible areas that remain to be studied. This investigation was a beginning.

# APPENDIX A

## THE FPS PROCESS - DIVERGENCY & CONVERGENCY



# APPENDIX B

# THE FPSP PACKET

## STEP 1. BRAINSTORMING POSSIBLE PROBLEMS

Now that you have thoroughly read and discussed the Fuzzy Situation, it is time to consider the many problems and difficulties related to it. Begin by brainstorming the many problems that may have caused the Fuzzy Situation or that may result from it. Select the TWENTY problems that you think are the most important and write them below and on the following pages. Word your problems clearly and completely, using statement (rather than question) form. Use the reverse side if necessary.

1.

2.

3.

4.

## STEP 1. BRAINSTORMING POSSIBLE PROBLEMS (continued)

5.

6.

7.

8.

## STEP 1. BRAINSTORMING POSSIBLE PROBLEMS (continued)

9.

10.

11.

12.

## STEP 1. BRAINSTORMING POSSIBLE PROBLEMS (Continued)

13.

14.

15.

16.

## STEP 1. BRAINSTORMING POSSIBLE PROBLEMS (continued)

17.

18.

19.

20.

## STEP II. IDENTIFYING AN UNDERLYING PROBLEM

Based on the problems you listed in Step I, identify a problem of major importance. Write your Underlying Problem in question form, beginning with the words, "In what ways might we . . . ?" or "How might we . . . ?" Your problem should clearly explain what you want to do, why it should be done, and any specific conditions.

## STEP III. BRAINSTORMING ALTERNATIVE SOLUTIONS

Brainstorm as many possible solutions as you can to your Underlying Problem. Choose your TWENTY most promising solutions to list below. Write each solution so that it describes WHO will carry out WHAT action, HOW it will be done, WHY it will solve the problem, and WHERE and WHEN this solution will take place. (Use reverse side, if necessary.)

1.

2.

3.

4.

STEP III. BRAINSTORMING ALTERNATIVE SOLUTIONS (continued)

5.

6.

7.

8.

## STEP III. BRAINSTORMING ALTERNATIVE SOLUTIONS (CONTINUED)

9.

10.

11.

12.

STEP III. BRAINSTORMING ALTERNATIVE SOLUTIONS (CONTINUED)

13.

14.

15.

16.

## STEP III. BRAINSTORMING ALTERNATIVE SOLUTIONS (Continued)

17.

18.

19.

20.

## STEP IV. CHOOSING CRITERIA FOR EVALUATING ALTERNATIVE SOLUTIONS

Your task now is to select the best solution from your Step III list. Brainstorm criteria that will help you decide which solution does the best job of solving <u>your</u> Underlying Problem. List below the FIVE criteria that you think are the most important for evaluating your solutions. Each criterion should have a different focus.

1.

2.

3.

4.

5.

## STEP V. EVALUATING ALTERNATIVE SOLUTIONS

From your list of solutions, select the TEN solutions that you think have the most potential. Use each criterion to rank the solutions on a scale from 1 (poorest) to 10 (best), and enter the numbers in the appropriate columns. Add the ranks you have given to each solution, and enter the sums in the TOTAL column.

| | ALTERNATIVE SOLUTIONS | CRITERIA 1 | 2 | 3 | 4 | 5 | TOTAL |
|---|---|---|---|---|---|---|---|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |
| 6. | | | | | | | |
| 7. | | | | | | | |
| 8. | | | | | | | |
| 9. | | | | | | | |
| 10. | | | | | | | |

## STEP VI. DESCRIBING THE BEST SOLUTION

Your task now is to describe your best solution. Explain what the solution will do, how it will work, why it will solve your Underlying Problem, and how it will relate to the Fuzzy Situation.

Include a description of your plan of action for carrying out the solution. You might consider some of the following concerns: Who will be involved? What actions will be taken? When and where will the plan be carried out? How might you overcome any obstacles? (Use reverse side, if necessary.)

# APPENDIX C

# SAMPLE BALLOT FOR FPSP TOPICS

**BALLOT FOR SELECTING TOPICS**
**for the 1993–94 Future Problem Solving Program**

INSTRUCTIONS: Review the descriptions of each topic with your students. Ask each to vote for 5 topics, then total all votes. Record the exact number of votes each topic receives in the space before each topic. The 5 topics receiving the most votes will be used for the 1993–94 program.

_____ ANTARCTICA: What used to be considered "no man's land" — a frozen wasteland — is looked at anew as a source for valuable resources, a political football, and as a key to our global environmental balance. What claims do humans have on this land? What will the Antarctica of the future be?

_____ THE BIOTECH REVOLUTION: Artificial production of "real" food for human consumption is on the horizon. Vegetable and fruit tissues have been grown in cultures without the rest of the plant. Are we ready for a bioprocess food system? Will this create an agricultural revolution?

_____ CONTROL OF DISEASE: Most major diseases have been eliminated, but some have recently made a comeback. Worldwide epidemics are being controlled, but many of these controls are hindered by lack of funds, poor diets, and transportation and communication systems. Future control of major diseases will depend on our ability to overcome these problems.

_____ DETERIORATING INFRASTRUCTURES: All over the world, it's become apparent that lack of maintenance has caused dams, highways, water systems, and buildings themselves to become overtired and untrustworthy. What are the problems relating to our deteriorating infrastructures?

_____ EXTINCTION OF ANIMALS: The continuing eradication of animal species is alarming. Contributing factors may include population growth of humans, toxic wastes, climate changes, loss of habitat due to deforestation, etc. Should mankind intervene in the eradication or is it part of evolution?

_____ GENETHICS: We can now modify the genetic functions of organisms. Human values may clash with science. Will this create ethical and social dilemmas? How can we decide where to place limits or if they are needed at all?

_____ INSTANCY — THE CURE FOR REALITY: It's a "quick fix" world of mood alteration through drugs, TV, even work. For the first time ever, parents are modelling life-on-the-run and instant gratification through their car phones, TV shopping, fax machines, and other trappings of "the good life." What are the by-products of a fast-paced "instant" life?

_____ NANOTECHNOLOGY: Recently there have been major breakthroughs toward the dream of realizing machines that control matter at the scale of molecules. Molecule-sized machines could offer a host of amazing benefits, from organ regeneration to habitat restoration to information processing and beyond, but could they also replace human beings as the planet's dominant force?

_____ NEUROSCIENCE: Brain studies have opened the door to cures and treatments for ailing mental patients and epileptics. Split-brain research has also opened up the ability to expand potential brain power. This exciting new science offers untold promise. Far-reaching cures hold promise and the threat of unexpected, undesirable consequences. Should limits be set? How far should human capabilities and experience expand?

_____ ORGAN TRANSPLANTS: Although the technology has been available for many years, people are dying needlessly because there are not enough organs available for all who need them. How should we decide who is entitled to available organs? Where should the organs come from? How can we be sure that the organs to be used are free from disease?

_____ THE POPULATION EXPLOSION: Some experts predict that many western nations are headed for zero-population growth; however, overpopulation still remains the world's number one environmental issue. Problems such as famine, global warming, acid rain, the garbage crisis, and water pollution can all be seen as resulting from overpopulation. How can we sustain our burgeoning population?

_____ REFUGEES: In our rapidly changing world order, people flee the motherland for a variety of reasons: economic, political, religious, ethical, and security. Where do these people "fit" in the societies they enter? What obligations do the future societies of the world have to those who leave their homeland? How does a "global view" impact the flight of refugees?

_____ ROBOTICS: The use of robots has increased rapidly worldwide. We can now equip them with a wide repertoire of senses and rudimentary intelligence. Many jobs have been replaced by robots in industry, health care, and teaching. Other jobs have been reduced in complexity, causing a loss of hours and pay to human workers. What are the problems in a world where robotics will play a major role?

_____ SPACE LAW: As the nations of the world are moving closer to establishing colonies in space, who has the right to dictate "ownership" of various parts of our solar system? How can we determine the laws that will govern our space pioneers?

_____ THE UNITED NATIONS: In the next few decades, will the United Nations' role be expanded or diminished? Can it become more effective in settling world disputes? With electronic stock markets, instant communication, and rapid travel from country to country, one nation's set of problems often becomes its neighbors. What role will the U.N. play in environmental issues, world hunger, education, and territorial claims in space?

_____ WORLD VALUE SYSTEMS: The value systems that we grow up with often dictate the way we react to things in later life. As our world becomes smaller and smaller due to technological advances, how will the differing values systems and mind-sets of world leaders affect their decision-making capabilities? Can they understand each others' viewpoint? What can be done to reduce the tensions between people of different cultures?

Number Voting: Students _____ Adults _____
Level of Team: _____

Complete and return by April 1, 1992, to:

The Future Problem Solving Program
315 W. Huron, Suite 140-B
Ann Arbor, MI 48103–4203

# APPENDIX D

# SAMPLE FUZZY

1988-89 FUTURE PROBLEM SOLVING PROGRAM
FIRST PRACTICE PROBLEM

## ENERGY SOURCES

Since 1990, when the North American Alliance (NAA) was formed, the member nations have dealt with several major problems. They found that complex issues were handled better when several countries worked together, than when each country faced the problems alone. Canada, the United States, the countries of Central America, and the Caribbean islands have all been very pleased with the successes of the NAA. Now, in 2015, the NAA is facing another major problem: energy.

All over the world oil and natural gas supplies have been used heavily during the last 50 years. At the same time few new large reserves have been discovered. Countries with large reserves have exported (sold) their oil and natural gas to countries with little or no oil and natural gas. As oil and natural gas supplies have been used up, fewer countries have been able to export their energy resources. The Organization of Petroleum Exporting Countries (OPEC) ceased to exist in 1997 when most of its members ran out of oil to export. The Union of Energy Exporting Countries (UEEC) was formed in 2002 by the few countries with enough oil and natural gas to export to other countries.

The NAA supplies its own energy sources, except for oil and natural gas. Oil and natural gas reserves in the NAA countries are almost gone, so these nations import (buy) most of their oil and natural gas from UEEC. Of the energy that the NAA countries use each year, the sources break down into the following categories:

| | Total | Imported | | Total | Imported |
|---|---|---|---|---|---|
| Oil: | 30% | 24% | Nuclear: | 12% | 0% |
| Natural gas: | 15% | 9% | Hydropower: | 10% | 0% |
| Coal: | 15% | 0% | Other: | 5% | 0% |
| Solar: | 13% | 0% | (including windpower and waste-to-energy) | | |

Until recently UEEC sold its oil and natural gas in unlimited amounts to any nation that could afford to pay for them. But one month ago leaders of UEEC met with leaders of all of the countries who import oil and natural gas from UEEC. At the meeting UEEC announced that its energy supplies will soon be gone unless some kind of action is taken. All of the leaders agreed that UEEC needs to ration (limit) the amount of oil and natural gas it is exporting. UEEC and the affected countries are hopeful that this move will keep UEEC's reserves available for at least 10 more years.

The NAA has known that oil and natural gas reserves have been shrinking, and it has been trying to prevent a major energy crisis. NAA countries have been increasing their use of energy sources other than oil and natural gas. Coal, solar, nuclear, water, wind, and waste-to-energy have all been energy sources that the NAA have used. However, the NAA nations still rely heavily on imported oil and natural gas. As a result of last month's meeting with UEEC, the NAA Cooperative Governing Council yesterday agreed that the NAA nations will stop importing oil and natural gas by the year 2025. The NAA is determined to find permanent solutions to its energy problems.

The goal will not be an easy one to meet. The NAA and its citizens face many energy problems in the years ahead. Use your problem solving skills to examine the situation for the NAA and its citizens.

# APPENDIX E

## SUMMARY OF FPSP STEPS WITH EVALUATION CRITERIA

SUMMARY OF THE EVALUATION PROCESS AS APPLIED BY THE MASSACHUSETTS FPSP DURING THE 1991-92 SCHOOL YEAR

| EVALUATION SECTION | CRITERION | SCALE TYPE | CRITERION TYPE |
|---|---|---|---|
| Problem Identification (Step 1) | Fluency | Frequency | Content & Process |
| | Flexibility | Frequency | Process |
| | Clarity | Rating | Structure |
| | Originality | Weighted | Content |
| Underlying Problem (Step 2) | Completeness | Composite | Structure |
| | Adequacy | Rating | Content |
| | Focus | Rating | Process |
| Alternative Solutions (Step 3) | Fluency | Frequency | Process |
| | Elaboration | Rating | Structure |
| | Flexibility | Rating | Process |
| | Originality | Weighted | Content |
| Criteria (Step 4 & 5) | Correctly Written | Composite | Structure |
| | Applicability & Relevance | Composite | Content |
| | Correctly Used | Composite | Structure |
| Best Solution (Step 6) | Relevance | Rating | Process |
| | Effectiveness | Rating | Content |
| | Impact | Rating | Content |
| | Humaneness | Rating | Content |
| Overall | Research Applied | Rating | Content |
| | Creative Strength | Rating | Content |

APPENDIX F

EVALUATION SCORESHEET FOR FPSP

**Evaluation Scoresheet**
**Future Problem Solving Program**

Problem Identification (Step 1)

Fluency ..... 1 2 3 4 5 6 7 8 9 10
Flexibility ..... 1 2 3 4 5 6 7 8 9 10
Clarity ..... 1 2 3 4 5 6 7 8 9 10
Originality ..... 3 x _____ = _____

Underlying Problem (Step 2)

Completeness ..... 0 1 2 3 4 5 6 7 8 9 10
Adequacy ..... 1 2 3 4 5 6 7 8 9 10
Focus ..... 1 2 3 4 5 6 7 8 9 10

Alternative Solutions (Step 3)

Fluency ..... 0 1 2 3 4 5 6 7 8 9 10
Elaboration ..... 0 1 2 3 4 5 6 7 8 9 10
Flexibility ..... 1 2 3 4 5 6 7 8 9 10
Originality ..... 3 x _____ = _____

Criteria (Steps 4 & 5)

Correctly written ..... 0 1 2 3 4 5
Applicability and relevance ..... 0 1 2 3 4 5 6 7 8 9 10
Correctly used ..... 1 2 3 4 5

Best Solution (Step 6)

Relevance ..... 1 2 3 4 5
Effectiveness ..... 1 2 3 4 5
Impact ..... 1 2 3 4 5
Humaneness ..... 1 2 3 4 5

Overall

Research Applied ..... 1 2 3 4 5 6 7 8 9 10
Creative Strength ..... 1 2 3 4 5 6 7 8 9 10

Rank _____ Total _____

# APPENDIX G

## PRESENTATION OF BEST SOLUTION SCORESHEET

TEAM #_____JUDGE:_____DIVISION:___JR ___INT ___SR

| | POOR | FAIR | GOOD | VERY GOOD | SUPERIOR |
|---|---|---|---|---|---|
| I. BASIC IDEA OF PRESENTATION | | | | | |
| Creativity of Presentation | 1 | 2 | 3 | 4 | 5 |
| Relationship of Presentation to Best Solution | 1 | 2 | 3 | 4 | 5 |
| II. CONTENT OF PRESENTATION | | | | | |
| Effectiveness of Solution | 1 | 2 | 3 | 4 | 5 |
| Positive Societal Influence of Solution | 1 | 2 | 3 | 4 | 5 |
| Completeness of Solution | 2 | 4 | 6 | 8 | 10 |
| III. PRESENTATION OF IDEA | | | | | |
| Use of Space on Stage | 1 | 2 | 3 | 4 | 5 |
| Involvement of Participants | 1 | 2 | 3 | 4 | 5 |
| Communication of Ideas (by verbal & nonverbal means) | 2 | 4 | 6 | 8 | 10 |
| IV. EFFECT OF PRESENTATION: | | | | | |
| Overall Persuasiveness of Presentation | 2 | 4 | 6 | 8 | 10 |

COMMENTS:

SUBTOTAL:

LESS PENALTIES:

TOTAL:

**********

Penalty points will be assessed for any of the following:

a. Presentation exceeds five-minute time limit (deduct 10 points)
b. Presentation is not clearly based on Best Solution (deduct 100% of total)
c. Props or costumes are made from things other than those on the approved list (deduct 10 points)

# APPENDIX H

# COMMUNITY PROBLEM SOLVING GUIDELINES

**AN INVITATION**
to participate in the
1989-90 FPS
**COMMUNITY PROBLEM SOLVING DIVISION**

**WHO IS ELIGIBLE?** Any coach who has participated in FPS or who has had training in the FPS process is eligible to direct a team in this component of FPS. A team may consist of any number of students. The work of the teams will be scored by grade-level divisions: 4-6; 7-9; and 10-12.

**WHAT IS IT?** Community Problem Solving is a chance for teams to use their problem-solving skills on currently existing real problems. A community problem may be one that exists within the school setting, the local community, the state or national community, or even the world community. Each team should identify a problem, find a solution, develop a plan to implement the solution, and begin to put that plan into effect.

**WHAT SHOULD BE SUBMITTED?** Each team's entry should include:

I. A cover sheet, which includes the names and grades of each of the team members, a mailing address, a telephone number, the name of the coach, and a statement, signed by the coach, attesting that the work is completely that of the students.

II. The report of the team's work, which should not exceed four sides of 8 1/2" x 11" paper. The report should be organized into four parts:

(1) The FUZZY SITUATION, a section describing the situation that the students first encountered;
(2) The UNDERLYING PROBLEM, which should follow the guidelines for the Underlying Problem used in the Regular FPSP;
(3) A section describing the team's BEST SOLUTION, which should include explanations of why the solution will solve the problem(s); and
(4) A section describing the team's IMPLEMENTATION PLAN with an explanation of the progress made putting that plan into effect.

Materials developed by the team to carry out the project may be included to document the achievements as presented in the four-page report. Though only the four-page report will be scored, such documentation may help the evaluators better understand the project. Any writing included in the report must be composed by the students, but may be typed by an adult for legibility.

III. A check (made payable to FPSP) for the entry fee of $20.00*

**WHERE SHOULD THE ENTRIES BE MAILED?** Entries should be mailed to the Future Problem Solving Program, St. Andrews College, Laurinburg, NC 28352.*

**WHEN SHOULD ENTRIES BE MAILED?** Entries must be postmarked by March 31, 1990.*

**HOW WILL THE ENTRIES BE EVALUATED?** Evaluators will judge the entries according to the criteria listed below. The numerical value of each criterion is shown in parentheses.

1. To what degree does the Fuzzy Situation describe the situation clearly? (0-4)
2. To what degree of importance are the issues and concerns presented in the Fuzzy Situation? (0-4)
3. To what degree is the Underlying Problem presented clearly? (0-4)
4. To what degree will the Underlying Problem, if solved, impact upon the Fuzzy Situation? (0-8)
5. To what degree is the Underlying Problem within the team's ability and resources to solve? (0-8)
6. To what degree is the Solution an original approach? (0-4)
7. To what degree is the Solution presented clearly? (0-4)
8. To what degree does the Solution resolve the Underlying Problem? (0-8)
9. To what degree will the Implementation Plan effectively carry out the solution? (0-8)
10. To what degree has the Implementation Plan been accomplished? (0-8)

**WHO WILL WIN?** Three teams, one at each grade-level division, will be recognized for their outstanding efforts.

**WHAT WILL THEY WIN?** Each winning team will receive an invitation to participate and compete in the 1990 International Future Problem Solving Conference at Washington University in St. Louis, Missouri on June 8-11, 1990. The three teams will also be invited to make short presentations about their projects at the Conference. Should the number of team members exceed four, it will be the coach's responsibility to select four students to represent the team at the Conference. Each first place team will be presented a plaque at the Awards Ceremony at the Conference.

**WHAT ELSE?** If you have questions, please call the national FPSP office (919 276-8361) or your state FPSP office for more information.

*Some state FPSPs are conducting state level Community Problem Solving competitions. Check with your State FPS Director to determine if you should participate at the state level or send your entry directly to the national office. If a state level competition is being held, your State FPS Director will be able to give you information about cost, date, and address.

# APPENDIX I

## SCENARIO WRITING SCORESHEET

Round_____ Division: Jr. (Int.) Sr.

Student Code I 10 Evaluator Code E4

Short-short story format ☐ Yes ☐ No

Recognizable relationship to one of topics ☐ Yes ☐ No

Length ☐ Within ☐ Exceeds

Comments:

| | Minimal development of characteristic | | Some development of characteristic | | Average development of characteristic | | Above average development of characteristic | | Excellent development of characteristic | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Creative Imagination (use of originality; surprise; humor; unusual plot) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (8) | 9 | 10 |
| 2. Social/Cultural Influences (purposeful; humane; strong sense of values; ecological concerns; global outlook) | 1 | 2 | 3 | 4 | 5 | (6) | 7 | 8 | 9 | 10 |
| 3. Feelings/Emotions (empathy; emotional reaction from the reader) | 1 | 2 | 3 | 4 | 5 | (6) | 7 | 8 | 9 | 10 |
| 4. Structure (story has beginning and end; has plot/conflict; is complete) | 1 | 2 | 3 | (4) | 5 | 6 | 7 | 8 | 9 | 10 |
| 5. Future Thinking (awareness of future trends) | 1 | 2 | 3 | 4 | 5 | (6) | 7 | 8 | 9 | 10 |
| 6. Interest (exciting to read; holds reader's attention) | 1 | 2 | 3 | 4 | 5 | 6 | (7) | 8 | 9 | 10 |
| 7. Character Development (character(s) developed as real and believable) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (8) | 9 | 10 |
| 8. Mechanics (Grammar; sentence structure; spelling) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (8) | 9 | 10 |
| 9. Style (Appropriate, consistent use of a noticeable, characteristic element: author's personal touch) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (8) | 9 | 10 |

# APPENDIX J

## COVER LETTER FOR COACHES

Dear Future Problem Solving Coach,

I am a graduate student at the University of Massachusetts in Amherst. Having been involved as a parent and as a coach in Future Problem Solving, I am writing a research paper on the Future Problem Solving Program in Massachusetts. What I'm looking for is information from you as coach about the way the program is run in your school system, what you think about the program, and how the program affects the students you are working with.

Since there are so many different ways that the program is implemented, it is of extreme importance that your responses are included in this study. To insure your freedom to say what you really think, the survey results will remain anonymous. Your answers will be nontraceable. No responses will be directly quoted. Paraphrasing will be used.

Your help is also needed in another way. Because of the laws protecting the privacy of students, the only means I have of reaching the students involved in the program is through you. I am asking you to distribute questionnaires to the students you coach so that the FPS Program can also be analyzed from the viewpoint of the students.

The information gathered will be compiled, categorized, and written up in my paper entitled "An Analysis of the Future Problem Solving Program in Massachusetts". The results will be sent to the

FPS State Director, National Directors, and possibly appear in educational journals.

The steps to take are:

1) Immediately fill out and send the enclosed postcard with the number of students you coach in Future Problem Solving (including those who did not make a "team").

The Student Surveys will be sent to you once I receive your postcard.

2) Relax with a cup of tea (teabag enclosed), to fill out the Coach's Survey. A return envelope is also enclosed for your completed survey. Please return your survey.

If you would like to see the results of these questionnaires, or if you have any questions, please feel free to contact me at home at 413-536-8643, or write to me at 16 Riverpark Ave., Chicopee, MA. 01013.

THANK YOU FOR YOUR COOPERATION!

Sincerely,

Irene T. Czerwiec

Irene T. Czerwiec

# APPENDIX K

## COACH SURVEY

DO NOT WRITE YOUR NAME ON THIS QUESTIONNAIRE!!!

FUTURE PROBLEM SOLVING IN MASSACHUSETTS

The purpose of the questionnaire is to find out about the Future Problem Solving Program in Massachusetts, how it is run in various school systems and how it affects the coaches and students.

This is not a test. No one will know which answers are yours. It is very important that you write what you think.

Thank you for being honest and for taking the time to fill out this survey.

REMEMBER: DO NOT PUT YOUR NAME ON THESE PAPERS.

---

BACKGROUND INFORMATION FOR COACHES

Directions: Circle all that apply.

1. I am a PARENT/COACH TEACHER/COACH OTHER (Explain)

2. Sex: MALE FEMALE

3. Number of years in Future Problem Solving (Counting this year): 1 2 3 4 5 6 7 8 9 10 OTHER___

4. When does your Future Problem Solving groups meet?: DURING SCHOOL - AFTER SCHOOL - EVENINGS - WEEKENDS - WHENEVER WE CAN - OTHER (Explain)_____

5. About how many hours in a week does each team meet?_____(fill in)

6. Approximately how many hours in a week do you meet with each team for Future Problem Solving activities? _____(fill in)

7. To how many students do you teach Future Problem Solving?_____

8. Number of your F.P.S. students who are identified as Gifted/Talented?____

9. Number of teams that you coach that are registered for Competitive Future Problem Solving?_____

DIRECTIONS: THE SENTENCES BELOW DESCRIBE SKILLS THAT FUTURE PROBLEM SOLVING (FPS) TRIES TO DEVELOP. SHOW HOW YOU THINK FUTURE PROBLEM SOLVING HAS AFFECTED YOUR STUDENTS BY CIRCLING THE NUMBER THAT IS CLOSEST TO YOUR ANSWER FOR EACH STATEMENT. READ EACH SENTENCE CAREFULLY. THERE ARE FIVE POSSIBLE ANSWERS.

| 1 = Not At All | 2 = Very Little | 3 = A Little | 4 = Fairly Much | 5 = A Lot |
|---|---|---|---|---|

Example: They can work well in a group. 1 2 (3) 4 5
(This means that your students can work a little better in a group because of Future Problem Solving.)

| | | | | | |
|---|---|---|---|---|---|
| 10. FPS helps my students to write their thoughts clearly enough for others to understand their meaning. | 1 | 2 | 3 | 4 | 5 |
| 11. They can verbally express their ideas to others in an understandable way. | 1 | 2 | 3 | 4 | 5 |
| 12. They know more places to look up information because of Future Problem Solving. | 1 | 2 | 3 | 4 | 5 |
| 13. They can draw out the facts they need from what they read. | 1 | 2 | 3 | 4 | 5 |
| 14. Future Problem Solving gives them a better idea of what it could be like in the future. | 1 | 2 | 3 | 4 | 5 |
| 15. People can make a difference in what will happen in the future. | 1 | 2 | 3 | 4 | 5 |
| 16. What they do has no effect on the future. | 1 | 2 | 3 | 4 | 5 |
| 17. They are aware of the problems in the world. | 1 | 2 | 3 | 4 | 5 |
| 18. They can think of many ideas in a short time. | 1 | 2 | 3 | 4 | 5 |
| 19. They can give ideas from different categories when they brainstorm. | 1 | 2 | 3 | 4 | 5 |
| 20. They can give unusual ideas when they brainstorm. | 1 | 2 | 3 | 4 | 5 |
| 21. They think that other people's ideas are not important. | 1 | 2 | 3 | 4 | 5 |
| 22. They think that it is important to know how to work as a team. | 1 | 2 | 3 | 4 | 5 |
| 23. They can think of new ideas when they learn new material. | 1 | 2 | 3 | 4 | 5 |
| 24. Given a number of facts, they can decide what is important. | 1 | 2 | 3 | 4 | 5 |
| 25. They understand that some problems don't have simple answers. | 1 | 2 | 3 | 4 | 5 |
| 26. Completing their work on time is important. | 1 | 2 | 3 | 4 | 5 |
| 27. They can give details to explain how a solution will work. | 1 | 2 | 3 | 4 | 5 |

29. How would you evaluate the support you receive from the following groups? For each group, place an "X" under one of the five possible ratings.

| | RATING | | | | |
|---|---|---|---|---|---|
| GROUP | Excellent | Very Good | Good | Fair | Poor |
| Classroom Teachers | | | | | |
| Parents | | | | | |
| Administrators | | | | | |
| The Community | | | | | |
| Media | | | | | |

30. How did you get involved in this program?

31. Why do you stay with Future Problem Solving?

32. Have you had any special opportunities because of your involvement with the F.P.S. Program? (Explain)

33. Have your students had any special opportunities because they were involved with F.P.S.? (Explain)

34. How do you feel about having different topics every year? Do you like it, dislike it, or are you neutral to this issue? (Explain)

35. What do you see as strengths of the Future Problem Solving Program?

36. What do you see as weaknesses in the Future Problem Solving Program?

37. Do you have any suggestions for improving the F.P.S. Program? (Explain)

38. Are any of your pupils involved with other aspects of Future Problem Solving? Check all that apply:

___Community Problem Solving
___Scenario Writing
___Visual Arts

Please feel free to add any comments. Use additional papers if necessary.

# APPENDIX L

## RESPONSE LETTER TO COACHES

Dear Coach,

Thank you for responding to my letter. Enclosed are the number of questionnaires you requested with a cover letter for each, and an addressed and stamped envelope for the return of each of the surveys. Please give a letter/survey and an envelope to each student.

If at all possible, would you take the time to have the students fill out their surveys (or at least start them) during the time that you meet with them? The return rate is much higher if they are not put aside for a later date. They can seal their surveys in the envelopes and mail them on their own or have you mail them if you wish.

Of course no student can be forced to fill out a survey. This is purely voluntary on their part. If anyone would like to take it home to have their parents help them, that is their choice. I would greatly appreciate it if you would stress the importance of the students filling out and returning the surveys. A reminder now and then would be extremely helpful. -

There is very little research available about Future Problem Solving. With the help of you and your FPS students, we can make a contribution to the pool of knowlege regarding the Future Problem Solving Program.

THANK YOU FOR YOUR COOPERATION!

Sincerely,

Irene Czerwiec

Irene Czerwiec
16 Riverpark Ave.
Chicopee, MA 01013
Phone: 413-536-8643

# APPENDIX M

## COVER LETTER FOR STUDENTS

Dear Future Problem Solver,

I am a graduate student at the University of Massachusetts in Amherst and am working on a special research project. From my experiences as a parent and a coach, I became very interested in Future Problem Solving. I would like to know more about the students in Massachusetts who learn Future Problem Solving, what skills they are learning, what they think about Future Problem Solving, and what experiences they have had because of FPS.

Since it is impossible for me to sit down with each of you and ask you these questions in person, I am asking you to write down your answers in the survey that is stapled to this letter. You do not put your name on these papers so there is no way that anyone (including your coach), will know which answers are yours. It is important that you say what you really think.

* When you have finished filling in your answers, seal the survey in the return envelope. The envelope is stamped and addressed. Please mail it back to me as soon as possible.

This is your chance to have a say in what is happening with the Future Problem Solving Program! The results from this study will be sent to the State and National Directors of Future Problem Solving and may possibly appear in educational journals.

NO ONE THINKS EXACTLY LIKE YOU, SO IT IS VERY IMPORTANT THAT YOU SEND YOUR ANSWERS. Thank you for taking the time to fill out this survey!

If you have any questions or would like to see the results of these surveys, please contact me at home at 413-536-8643 or write to me at 16 Riverpark Ave., Chicopee, MA. 01013.

Sincerely,
Irene Czerwiec
Irene Czerwiec

# APPENDIX N

## STUDENT SURVEY

DO NOT WRITE YOUR NAME ON THIS QUESTIONNAIRE!!!

### FUTURE PROBLEM SOLVING AND YOU

The purpose of the questionnaire is to find out about students in Massachusetts and how Future Problem Solving affects them.

This is not a test. No one will know which answers are yours. It is very important that you write what you think.

Thank you for being honest and for taking the time to fill out this survey.

REMEMBER: DO NOT PUT YOUR NAME ON THESE PAPERS.

---

### BACKGROUND INFORMATION

Directions: Circle your answers.

1. GRADE YOU ARE IN: 4 5 6 7 8 9 10 11 12 College

2. SEX: Male Female

3. NUMBER OF YEARS IN FUTURE PROBLEM SOLVING (Counting this year): 1 2 3 4 5 6 7 8 9 10 Other__

4. WHEN DOES YOUR FUTURE PROBLEM SOLVING GROUP MEET?: During school - After school - Evenings - Weekends - Whenever we can - Other (Explain)_____

5. ABOUT HOW MANY HOURS DO YOU MEET IN A WEEK?_____(fill in)

6. ABOUT HOW MANY HOURS DO YOU MEET IN A WEEK FOR FUTURE PROBLEM SOLVING ACTIVITIES?_____(fill in)

7. CIRCLE THE LETTER(S) OF ALL THAT ARE TRUE:
   A. We learn Future Problem Solving in a class or program that I'm in.
   B. I do not learn Future Problem Solving in any of the classes or programs that I'm in.
   C. I had to learn Future Problem Solving.
   D. I chose to learn about Future Problem Solving.
   E. I am on a Future Problem Solving team.
   F. I learned Future Problem Solving but am not on a team.

DIRECTIONS: THE SENTENCES BELOW DESCRIBE SKILLS THAT FUTURE PROBLEM SOLVING (FPS) TRIES TO DEVELOP. SHOW HOW YOU THINK FUTURE PROBLEM SOLVING HAS AFFECTED YOU BY CIRCLING THE NUMBER THAT IS CLOSEST TO YOUR ANSWER FOR EACH STATEMENT. READ EACH SENTENCE CAREFULLY. THERE ARE FIVE POSSIBLE ANSWERS.

| 1 = Not At All | 2 = Very Little | 3 = A Little | 4 = Fairly Much | 5 = A Lot |
|---|---|---|---|---|

Example: I can work well in a group. 1 2 (3) 4 5
(This means that you can work a little better in a group because of Future Problem Solving.)

| | Not At All | | A Little | | A Lot |
|---|---|---|---|---|---|
| 8. Future Problem Solving helps me to write my ideas clearly enough for others to know what I mean. | 1 | 2 | 3 | 4 | 5 |
| 9. I can tell my thoughts to others so they understand what I mean. | 1 | 2 | 3 | 4 | 5 |
| 10. I know more places to look up information because of Future Problem Solving. | 1 | 2 | 3 | 4 | 5 |
| 11. I can pick out the facts I need from what I read. | 1 | 2 | 3 | 4 | 5 |
| 12. Future Problem Solving gives me a better idea of what it could be like in the future. | 1 | 2 | 3 | 4 | 5 |
| 13. People can make a difference in what will happen in the future. | 1 | 2 | 3 | 4 | 5 |
| 14. What I do has no effect on the future. | 1 | 2 | 3 | 4 | 5 |
| 15. I know about the problems in the world. | 1 | 2 | 3 | 4 | 5 |
| 16. I can think of many ideas in a short time. | 1 | 2 | 3 | 4 | 5 |
| 17. I can give ideas from different categories when I brainstorm. | 1 | 2 | 3 | 4 | 5 |
| 18. I can give unusual ideas when I brainstorm. | 1 | 2 | 3 | 4 | 5 |
| 19. Other people's ideas are not important. | 1 | 2 | 3 | 4 | 5 |
| 20. It is important to know how to work as a team. | 1 | 2 | 3 | 4 | 5 |
| 21. I can think of new ideas when I learn new material. | 1 | 2 | 3 | 4 | 5 |
| 22. Given a number of facts, I can decide what is important. | 1 | 2 | 3 | 4 | 5 |
| 23. I understand that some problems don't have simple answers. | 1 | 2 | 3 | 4 | 5 |
| 24. Doing my work on time is important. | 1 | 2 | 3 | 4 | 5 |
| 25. I can give details to explain how a solution will work. | 1 | 2 | 3 | 4 | 5 |

26. What special experiences have you been exposed to because of the Future Problem Solving Program? (Guest speakers, field trips, special events, media coverage etc.)
Explain.

27. What do you like about Future Problem Solving? Explain.

28. What don't you like about Future Problem Solving? Explain.

29. What suggestions do you have for improving the Future Problem Solving Program?

30. Comments. What else would you like to say about the Future Problem Solving Program itself, or about your experiences with it?

# APPENDIX O

## FOLLOW-UP LETTER

Dear Future Problem Solving Coach,

Hello again. I'm the person who sent you a letter in April regarding a research project that I'm working on about Future Problem Solving in Massachusetts. As of this date, I have not received the postcard from you regarding the number of students to whom you teach Future Problem Solving.

1) If you forgot to send the postcard or the questionnaire, the deadline has been extended so you can still drop it in the mail, please.

2) If you chose not to participate or not have your students participate in the study, please return the postcard with a note on it saying that you will not be involved in the study.

* NOTE: You do not have to be involved in competitive problem solving such as a Bowl event to be part of this study. The only requirement is that you taught the Future Problem Solving process at some point during the 1988-89 school year.

3) If you have dropped out of the program, it would be very helpful for my research to know the reason(s) for that decision. You can note them on the postcard or, preferably, the Coach's Survey.

For those of you who have returned the Coach's Survey, I extend a sincere thank you for your response. For those who have not yet returned it, I would appreciate it if you would do so.
The deadline for the Student Surveys is extended.

If you have misplaced your Coach's Survey, please note it on your postcard and I'll send you a replacement. If you never received the original packet or have misplaced the whole letter/postcard packet and would like to be part of the study, please notify me by mail or phone and I'll send one out to you.

Thank you for your support!

Sincerely,

Irene T. Czerwiec

Irene T. Czerwiec
16 Riverpark Ave.
Chicopee, MA 01013
Home Phone:
413-536-8643 (after 3)

P.S. I hope you enjoyed your cup of tea.
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# APPENDIX P

## NUMERIC VALUES FOR CONVERSIONS OF SURVEYS

The numeric conversions from the coach surveys (see Appendix K) were as follows:

From the First Page of the Coach Survey:

Q. 1 -- Parent/Coach -->1; Teacher/Coach -->2; Other -->3.

Q. 2 -- Male -->1; Female -->2.

Q. 4 -- During School -->1; After School -->2; Evenings -->3; Weekends -->4; Whenever We Can -->5; Other -->6; During School and Other Times -->7.

The responses to questions 3, 5, 6, 7, 8, and 9 were numerals.

From the Second Page of the Coach Survey:

Q. 10 through 27 were Likert responses on a five-point scale. The only necessary conversions were for the two reverse questions # 16 and 21. The responses were reversed with 5 switching with 1, and 4 switching with 2 so that the meaning of the answers would match for statistical analysis.

From the Third Page of the Coach Survey:

Q. 29 -- Excellent -->5; Very Good -->4; Good -->3; Fair -->2; Poor -->1.

Q. 30 through Q. 33 responses were tallied and grouped as follows.

Q. 30 -- "How did coach get involved in the program?"
As a Parent -->1; Interest -->2; Conference/Workshop -->3; Part of Class or G/T Program -->4; Through Principal or Administrator -->5; Promotional Material -->6; Other Teachers or Coaches -->7; Don't Remember -->8.

Q. 31 -- "Why do you stay with FPS?"
Not Staying In -->0; Benefits for Students -->1; Benefits for Coaches -->2; Benefits for Students and Coaches -->3; Neutral -->4.

Q. 32 -- "Any special opportunities for coach due to FPS?"
Bowl Events; Field Trips; Guest Speakers; Media Coverage or Recognition; Special Events; Miscellaneous.
Responses to the above coded No -->0, Yes -->1 for each.

Q. 33 -- "Any special opportunities for students due to FPS?"
Categorized and coded the same as q. 32.

From the Fourth Page of the Coach Survey:

Q. 34 -- "Coach's reaction to different topics each year."
Like It -->1; Dislike It -->2; Neutral -->3.

Q. 35 -- "Strengths of the FPSP as seen by coach."
Creativity; Critical Thinking/FPS Process; Real Topics Affecting Students; Teamwork/Group Effort; Miscellaneous.
Responses coded No -->0; Yes -->1 to each category above.

Q. 36 -- "Weaknesses of the FPSP as seen by coach."
Difficulty of Process; Time; Evaluation; Lack of Support or Funding; Miscellaneous.
Responses coded No -->0; Yes -->1 to each category above.

Q. 37 -- "Suggestions for improving the FPSP."
Regional Bowls; Training; Funding; Evaluation/Feedback; Time; Topics; Miscellaneous.
Responses coded No -->0; Yes -->1 to each category above.

Q. 38 -- "Are coach's students involved in other aspects of FPSP?"
Community Problem Solving; Scenario Writing; Visual Arts.
Responses coded No -->0; Yes -->1 to each aspect above.

The comments that were given at the end of the survey were analyzed by the researcher and assigned a value. (see Appendix R)

Positive -->1; Negative -->2; Neutral --> 3.

To try to capture the overall enthusiasm of the responses to all of the essay questions and comments of each respondant, the researcher assigned a number to the set of responses for each coach. (see Appendix S)

Very Negative -->1; Neg. -->2; Neutral -->3; Positive -->4;
Very Positive -->5.

Judgement was made by the degree of the responses. The use of superlative words such as "greatest" or "most" in a positive comment was given a value of 5. The comparative degree of "better than" or use of "good" led to the assigment of a 4 value. Neutral responses were those that couldn't be judged as positive or negative. Very negative was distinguished by negative by the use of comparative and superlative degrees. In questionable cases, the researcher assigned the lower value. This was done to counteract any possible bias by the researcher.

Since some questions on the surveys from the coaches were left blank, it was necessary to assign values for missing information. Questions 6, 10 to 27, 29, 31, 34, and comments were assigned a 9 for missing responses. Questions 7 and 8 were assigned 99 for missing data. Questions 32, 33, 35 through 38 were coded 2 for blank responses.

The numeric conversions from the student surveys (see Appendix N) were as follows:

From the First Page of the Student Survey:

Q. 2 -- Male -->1; Female -->2.

Q. 4 -- During School -->1; After School -->2; Evenings -->3; Weekends -->4; Whenever We Can -->5; Other -->6; During School and Other Times -->7.

The responses to questions 1, 3, 5, and 6 were numerals.

Q. 7 -- Each of the six components were coded No -->0; Yes -->1.

From the Second Page of the Student Survey:

Q. 8 through 25 were Likert responses on a five-point scale. The only necessary conversions were for the two reverse questions # 14 and 19. The responses were reversed with 5 switching with 1, and 4 switching with 2 so that the meaning of the answers would match for statistical analysis.

From the Third Page of the Student Survey:

Q. 26 through Q. 30 responses were tallied and grouped as follows.

Q. 26 -- "Any special opportunities for students due to FPS?"
Bowl Events; Field Trips; Guest Speakers; Media Coverage or Recognition; Special Events; Miscellaneous.
Responses to the above coded No -->0, Yes -->1 for each

Q. 27 -- "What do you like about FPS?"
Communication; Creativity; Gain Knowlegde; Future; Teamwork; Make a Difference; Thinking Skills; Bowls and Opportunities; Miscellaneous.
Responses coded No -->0; Yes -->1 to each category above.

Q. 28 -- "What don't you like about FPS?"
Boring; Difficult; Time; Topics; Work; Social Issues; Miscellaneous.
Responses coded No -->0; Yes -->1 to each category above.

Q. 29 -- "Suggestions for improving the FPSP."
Easier; Eliminate Program; Expand Program; More Opportunities; Time; Topics; Social Issues; Miscellaneous.
Responses coded No -->0; Yes -->1 to each category above.

Q. 30 -- The comments that were given at the end of the survey were analyzed by the researcher and assigned a value. (see Appendix R)
Positive -->1; Negative -->2; Neutral --> 3.

To try to capture the overall enthusiasm of the responses to all of the essay questions and comments of each respondant, the researcher assigned a number to the set of responses for each student. (see Appendix S)

Very Negative -->1; Neg. -->2; Neutral -->3; Positive -->4; Very Positive -->5.

Judgement was made by the degree of the responses. The use of superlative words such as "greatest" or "most" in a positive comment was given a value of 5. The comparative degree of "better than" or use of "good" led to the assigment of a 4 value. Neutral responses were those that couldn't be judged as positive or negative. Very negative was distinguished by negative by the use of comparative and superlative degrees. In questionable cases, the researcher assigned the lower value. This was done to counteract any possible bias by the researcher.

Since a few questions on the surveys from the students were left blank, it was necessary to assign values for missing information. The missing value

defaults were for: questions 1, 5, and 6 blanks assigned 99; questions 2 and 4 blanks coded 0; question 3 assigned 9.0; questions 8 through 25 and enthusiasm coded 9; and questions 26 through 30 assigned 2 for missing data.

# APPENDIX Q

# ASSIGNMENT OF CATEGORIES TO ESSAY RESPONSES

## APPENDIX Q.1 CATEGORIES OF RESPONSES FROM COACHES' ESSAYS

Ques. 30. How did you get involved in this (FPS) program?
Response Categories:
As a parent of a child in the FPSP.
Interest.
Conference/Workshop
Part of Class or G/T Program
Through Principal/Administrator
Promotional Material
Other Teachers/Coaches
Combination of Factors.

Ques. 31. Why do you stay with Future Problem Solving?
Response Categories:
Beneficial for Students (ex. Teaches students important skills. Encourages teamwork and cooperation. Skills help in schoolwork. FPSP is powerful for developing and nurturing thinking skills.)
Beneficial for Coaches (ex. Enjoy working with gifted kids, I learn about my world.)
Beneficial for Coaches and Students (ex. FPS encourages activism in problem solving. Process can be used for rest of life.)

Ques. 32. Have you had any special opportunities because of your involvement with the FPS Program?
Response Categories:
Bowl Events (Regional, state, or national).
Field Trips.
Guest Speakers.
Media Coverage/Recognition.
Special Events (ex. Spoke before the town committee. Community agencies worked with students).
Miscellaneous (ex. Met other parents & coaches with the same ideals. Opportunity to do something important with enthusiastic kids.)

Ques. 33. Have your students had any special opportunities because they were involved with FPS?
Response Categories:
(same as question 32 above)
Miscellaneous (ex. Pride in accomplishments, self, and school.)

Ques. 35. What do you see as strengths of the Future Problem Solving Program?
Response Categories:
Creativity (It's OK that your ideas are different. Fluency, flexibility, originality, and elaboration. Brainstorming).
Critical Thinking/FPS Process.
Real Topics Affecting Students.
Teamwork/Group Effort.

Miscellaneous (ex. Motivation - through field trips, speakers, research. Learn to be responsible.)

Ques. 36. What do you see as weaknesses in the Future Problem Solving Program?
Response Categories:
Difficulty of the Process (ex. Difficult to initially learn process. Strict procedure difficult for younger students.)
Time (ex. Not enough time for each topic. Competitions are on Saturdays. Students are overcommitted to too many things.)
Evaluation (ex. Subjectivity, takes too long, negative comments.)
Lack of Support/Funding (ex. Lack of recognition as an educational program. No funding at state level.)
Miscellaneous (ex. Unproductive students made the whole group mediocre.)

Ques. 37. Do you have any suggestions for improving the FPS Program?
Response Categories:
Regional Bowls (ex. Have regional bowls all in one day. Continue regional bowls.)
Training (ex. Have more support for first year coaches.)
Funding (ex. Get corporate funding.)
Evaluation/Feedback (ex. Return feedback sooner.)
Time (ex. Send materials to coaches earlier in school year so they have more time to prepare.)
Topics (ex. More appropriate topics for juniors.)
Miscellaneous (ex. Have activity booklets for students for each topic.)

## APPENDIX Q.2 CATEGORIES OF RESPONSES FROM STUDENTS' ESSAYS

Ques. 26. What special experiences have you been exposed to because of the Future Problem Solving Program?
Response Categories:
Bowl Events (Regional, state, national).
Field Trips (ex. Sewage plant, nuclear plant, DYS Center, swamp, courthouse, jail.)
Guest Speakers (ex. Astronaut, head heart surgeon at Mass. General, immigration lawyer.)
Media Coverage
Special Events (ex. Helped at children's museum, planned a walk-a-thon to help a hospice.)
Miscellaneous ( ex. Saw films, got to work in groups.)

Ques. 27. What do you like about Future Problem Solving?
Response Categories:
Communication (ex. Can speak out freely. Can write better.)
Creativity (ex. Can get credit for unusual ideas. Using my imagination, brainstorming.)
Gain Knowledge (ex. Learn about major problems, what could happen if nobody cared.)
Future (ex. Fun way to look at the future. Helps kids make decisions we may have to make in the future. Prepares me for future.)
Teamwork (ex. Working in a group, leading a group.)
Make a Difference (ex. Changing the world for the better.)
Thinking Skills (ex. Makes you think, challenges.)
Bowls & Opportunities
Miscellaneous (ex. Helps me with other work because it teaches you to get organized. Can use my brain without being called a "nerd.")

Ques. 28. What don't you like about Future Problem Solving?
Response Categories:
Boring (ex. Gathering research can be boring.)
Difficult (ex. Problems too hard. Can't understand the questions. Frustrating. Topic too hard.)
Time (ex. Time interferes with other classes.
Topics (ex. Can't choose own topics.)
Work (ex. Takes lots of effort.)
Social Issues (ex. Being the only girl on the team. People in my group don't always behave. Lack of commitment of some members.)
Miscellaneous (ex. Coach can be picky. Not enough publicity. Getting nervous before bowls.)

Ques. 29. What suggestions do you have for improving the Future Problem Solving Program?
Response Categories:
Make it Easier (ex. Make directions easier, less rules.)
Eliminate it.
Expand it. (ex. Open it to more kids. Have it in high school, lower grades. Have more schools. )

More Opportunities (ex. More field trips, speakers.)
Time (ex. Start earlier in the year. Give more time for the packet.)
Topics (ex. Let kids choose. More relevant topics.)
Social Issues (ex. Pick your own teammates. Have parties or gatherings so different teams could interact.)
Miscellaneous (ex. More publicity. Train coaches better.)

# APPENDIX R

## SAMPLES OF COMMENTS JUDGED BY RESEARCHER

### APPENDIX R.1 SAMPLES OF COACHES' COMMENTS

| | |
|---|---|
| FPS is the best thing I've ever done as a teacher. | Positive |
| It is hard and time consuming but well worth it. | Positive |
| Visual Arts entries were returned to students without any comments. | Negative |
| FPS has afforded great success at improving skills and forming group cohesion for students who are shy, unorganized, and have difficulty sharing. | Positive |
| State Director should be commended. | Positive |
| Would like to try different colleges for the State Bowl. | Neutral |

### APPENDIX R.1 SAMPLES OF STUDENTS' COMMENTS

| Students' Comments | Judged Value |
|---|---|
| Whether I likee it or not depends on the topic. | Neutral |
| It's good that they started the program. It helps kids understand more about the future. | Positive |
| Great program. Whoever though of it is a great person. | Positive |
| It stinks and so did my experiences. | Negative |
| It's boring. | Negative |
| Should try to get FPS classes into more schools. | Positive |
| I love it. It was one heck of an experience! | Positive |
| Haven't had much experience with it. | Neutral. |
| It helped me stretch my imagination. | Positive |
| It's the best way to learn about the future. | Positive |
| It's okay but I wouldn't want it as a career. | Neutral |

# APPENDIX S

## SAMPLES OF JUDGED ENTHUSIASM OF RESPONSES

From Appendix S - judged enthusiasm of coach as very negative.

29. How would you evaluate the support you receive from the following groups? For each group, place an "X" under one of the five possible ratings.

| GROUP | RATING | | | | |
|---|---|---|---|---|---|
| | Excellent | Very Good | Good | Fair | Poor |
| Classroom Teachers | | | | | ✓ |
| Parents | | | ✓ | | |
| Administrators | | | | ✓ | |
| The Community | | | | | ✓ |
| Media | | | | | ✓ |

They don't care. Kyle is what is supposed to attend. Help pull-in Kyle to stay after school. They don't care as long as it gets done

30. How did you get involved in this program? Principal asked if I would do it because of pressure from superintendent. We did not have gifted program at secondary level - this lends a public relations more.

31. Why do you stay with Future Problem Solving?

I probably will not be with program next year because at present time burned out. Very disappointed in group I had this year - no enthusiasm - 2 girls I would have chosen.

32. Have you had any special opportunities because of your involvement with the F.P.S. Program? (Explain) No

33. Have your students had any special opportunities because they were involved with F.P.S.? (Explain) No.

* When it came to giving awards at end of year - "No time" - awards automatically are given. Students deserve - were told - given more out of school.

34. How do you feel about having different topics every year?
Do you like it, dislike it, or are you neutral to this issue?
(Explain) Good idea I feel along with kids

(1)

35. What do you see as strengths of the Future Problem Solving Program?
1. Kids learn to work together - co-operate
2. Kids try to be innovative and creative
3. Kids try to solve problems using certain skills & procedures - perhaps a help to them in future

36. What do you see as weaknesses in the Future Problem Solving Program? Weakness at this end - I find it hard to choose Topic because grade 8 kids are involved in too many activities and great - kids come from 4 different schools and I must make a choice but I feel kids have many extracurricular activities

37. Do you have any suggestions for improving the F.P.S. Program?
(Explain) I can only a problem in the Regional bowl - we did not attend because kids refused to go. Also our system is very concerned with mobility, and even if I drive, I doubt kids would be able to come in my car.

38. Are any of your pupils involved with other aspects of Future Problem Solving? Check all that apply:
No.
___Community Problem Solving
___Scenario Writing
___Visual Arts

Please feel free to add any comments. Use additional papers if necessary.

From Appendix S judged enthusiasm of coach as very positive.

29. How would you evaluate the support you receive from the following groups? For each group, place an "X" under one of the five possible ratings.

| | RATING | | | | |
|---|---|---|---|---|---|
| GROUP | Excellent | Very Good | Good | Fair | Poor |
| Classroom Teachers | | X | | | |
| Parents | X | | | | |
| Administrators | X | | | | |
| The Community | X | | | | |
| Media | | X in the past | X this year | | |

30. How did you get involved in this program?
As a gifted / talented teacher. I knew about the program and thought it would be an interesting activity for my gr. 6 students.

31. Why do you stay with Future Problem Solving? I was right! They (the students) really loved F.P.S.. I was overwhelmed with the work involved and vowed to do only, but my 2nd year our team was very successful in the competition and the next group coming along was very enthusiastic about F.P.S. - so here I am.

32. Have you had any special opportunities because of your involvement with the F.P.S. Program? (Explain) It is a terrific program. The best part is the opportunity to do something important and worthwhile with a group of enthusiastic and commited kids. I have met some very interesting people (as part of the research). The competitions are great and we have been to Michigan for competition - ↓ use

33. Have your students had any special opportunities because they were involved with F.P.S.? (Explain) so little space!
travel - meeting kids from all over the U.S.
competitions - working together under pressure - seeing other teams
research & resources - learning where & how to get information, being resourceful in getting interesting speakers.
challenge - the biggest academic challenge the have ever had - and perhaps will have.
working as a team / making a commitment / organization (information, notes team.)

(32) I have also done some inservice work in F.P.S. + working

34. How do you feel about having different topics every year?
Do you like it, dislike it, or are you neutral to this issue?
(Explain) (1) OK - the kids usually feel that they could do much more work on a topic once they get started & have to end the reseach too soon. At the end of the year they feel that they have learned a lot of material. It never gets boring! And it is a good variety.

35. What do you see as strengths of the Future Problem Solving Program? - see opportunities 32133

1. Challenge - academic - learning about important topics
2. Working as a team - something that doesnt happen until adulthood & so important - Cooperative learning takes place in F.P.S..
3. Kids learn that they can do something, learn to be responsible

36. What do you see as weaknesses in the Future Problem Solving Program? Intense! I found having the Regional Bowl this year to be hard - too much competition so soon - but the kids liked it and after it was over I liked it. It has made the competition for State easier to train for.

37. Do you have any suggestions for improving the F.P.S. Program?
(Explain) Regional Bowls all on one day. so that the evaluation could get done more efficiently. Perhaps a state F.P.S. board with Regional directors. I think Ann Hoyle does a fabulous job - but she could use more help.

38. Are any of your pupils involved with other aspects of Future Problem Solving? Check all that apply:

- ✓ Community Problem Solving
- ___ Scenario Writing
- ✓ Visual Arts

Please feel free to add any comments. Use additional papers if necessary.

I think that F.P.S. is the best thing I have ever done as a teacher. I feel that the things the kids learn are all opportunities that they do not get any where else in school. The program is hard and time consuming - but "nothing good comes easy". My only problem is that I get obsessed with F.P.S. This year several parents and my principal have become involved as coaches and

From Appendix S - student responses judged as <u>very negative.</u>

26. What special experiences have you been exposed to because of the Future Problem Solving Program? (Guest speakers, field trips, special events, media coverage etc.)
Explain.

NONE

27. What do you like about Future Problem Solving? Explain.

NOTHING

28. What don't like about Future Problem Solving? Explain.

EVERYTHING

29. What suggestions do you have for improving the Future Problem Solving Program?

GET RID OF IT

30. Comments. What else would you like to say about the Future Problem Solving Program itself, or about your experiences with it?

IT STINKS
AND SO DID
MY EXPERIENCES

3

From Appendix S - student responses judged as <u>negative.</u>

26. What special experiences have you been exposed to because of the Future Problem Solving Program? (Guest speakers, field trips, special events, media coverage etc.)
Explain.

We went to the Regional Level in Wheaton which was a little bit boring, we also had a guest speaker about ~~nuclear~~ nuclear.

27. What do you like about Future Problem Solving? Explain.

Sometimes you have challenging work and I like that.

28. What don't like about Future Problem Solving? Explain.

Sometimes it's very boring.

29. What suggestions do you have for improving the Future Problem Solving Program?

Have more real creative activities instead of worksheets and notes.

30. Comments. What else would you like to say about the Future Problem Solving Program itself, or about your experiences with it?

Well, it's okay it's not the funnest thing in the world and I hope I'm not in it next year

From Appendix S - student responses judged as <u>neutral.</u>

26. What special experiences have you been exposed to because of the Future Problem Solving Program? (Guest speakers, field trips, special events, media coverage etc.)
Explain.

Nothing

27. What do you like about Future Problem Solving? Explain.

Finding I don't

28. What don't like about Future Problem Solving? Explain.

Nothing

29. What suggestions do you have for improving the Future Problem Solving Program?

Nothing

30. Comments. What else would you like to say about the Future Problem Solving Program itself, or about your experiences with it?

I think it is fun but sometimes it is hard

From Appendix S - student responses judged as <u>positive.</u>

26. What special experiences have you been exposed to because of the Future Problem Solving Program? (Guest speakers, field trips, special events, media coverage etc.)
Explain.

nothing

27. What do you like about Future Problem Solving? Explain.

It makes you think.

28. What don't like about Future Problem Solving? Explain.

It takes such a long time.

29. What suggestions do you have for improving the Future Problem Solving Program?

Make the subjects of the problem solving exciting

30. Comments. What else would you like to say about the Future Problem Solving Program itself, or about your experiences with it?

It's fun. I like the way a team gets to work together and vote on things.

From Appendix S - student responses judged as very positive.

26. What special experiences have you been exposed to because of the Future Problem Solving Program? (Guest speakers, field trips, special events, media coverage etc.)
Explain. We went on 5 field trips. We have arround twenty guest speakers come and talk to us. The Providence Journal has come 1 time. The SunChronicle has come 3 times.

27. What do you like about Future Problem Solving? Explain.
I like it when we win and go to MIT for the state bowl. I also like it when we make jokes about going to Migchigan.

28. What don't like about Future Problem Solving? Explain.
I don't like doing the problems because you sometimes get stumped where as doing solutions you can write anything.

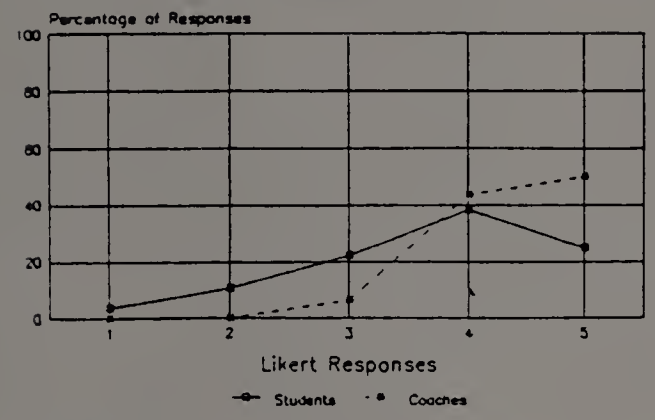
29. What suggestions do you have for improving the Future Problem Solving Program? I think they should have individuals at the regional bowls.

30. Comments. What else would you like to say about the Future Problem Solving Program itself, or about your experiences with it?
I think altogether it is an exellent thing for children to do!

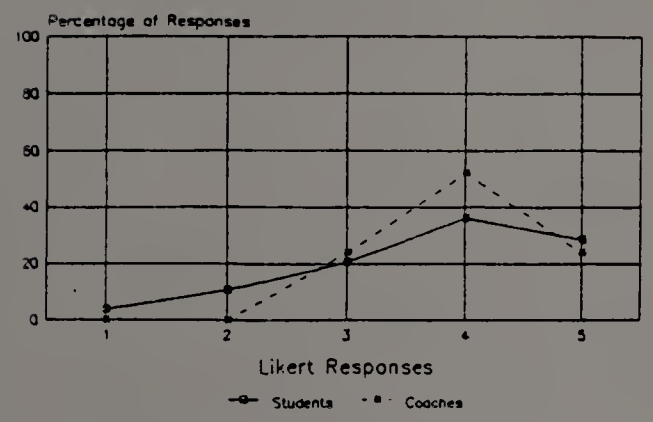
# APPENDIX T

## GRAPHS OF PERCENTS OF RESPONSES TO LIKERT QUESTIONS

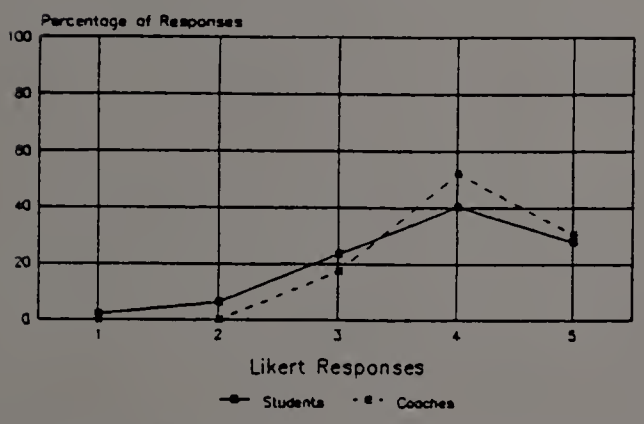
% OF RESPONSES TO QUESTIONS CONCERNING BLOOM'S TAXONOM



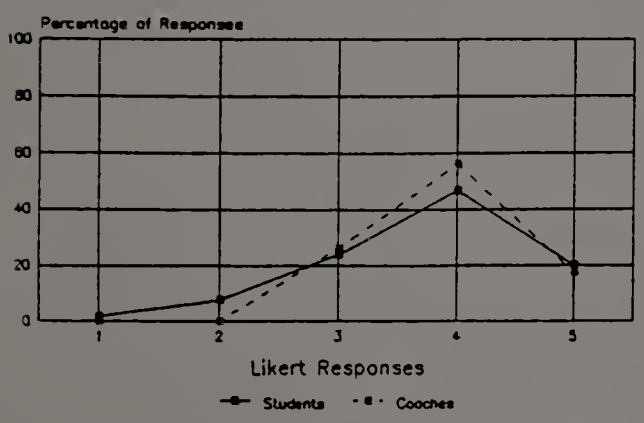

15. I know about the problems in the world.



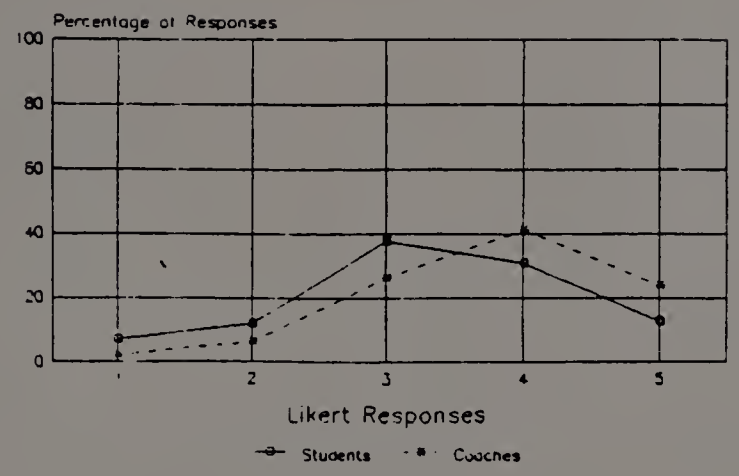

11. I can pick out the facts I need from what I read.



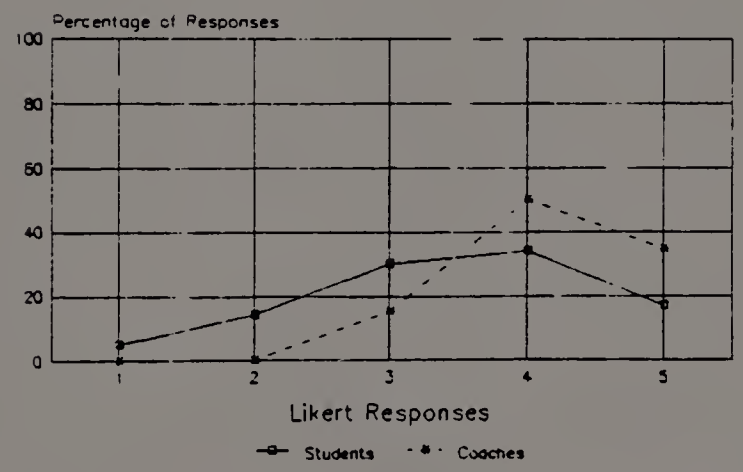

21. I can think of new ideas when I learn new material.




22. Given a number of facts, I can decide what is important.

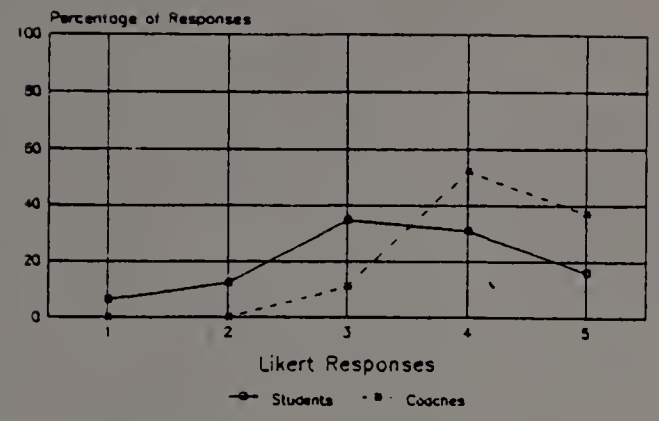



8. Future Problem Solving helps me to write my ideas clearly enough for others to know what I mean.

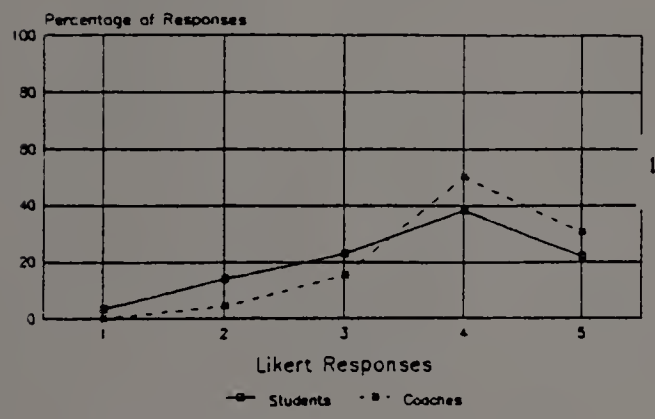



9. I can tell my thoughts to others so they understand what I mean.

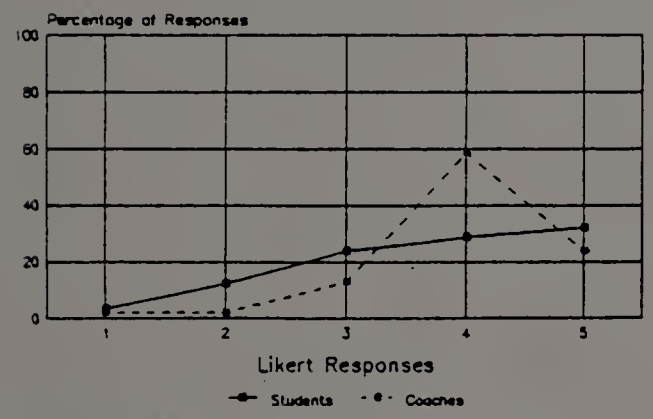
# % OF RESPONSES TO QUESTIONS CONCERNING CREATIVITY



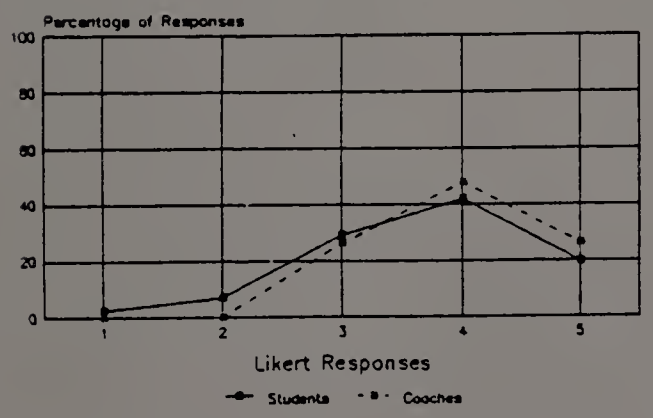

16. I can think of many ideas in a short time.




17. I can give ideas from different categories when I brainstorm.

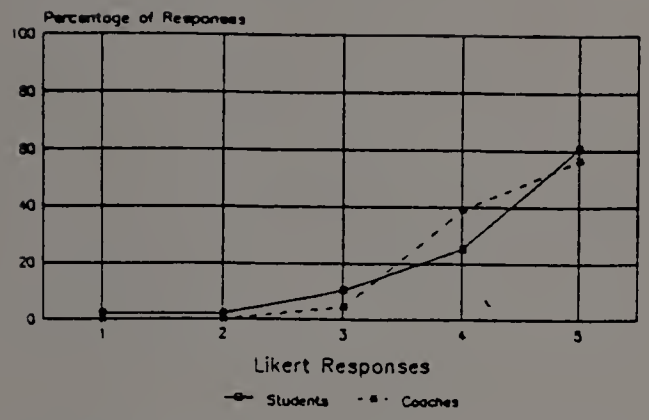



18. I can give unusual ideas when I brainstorm.

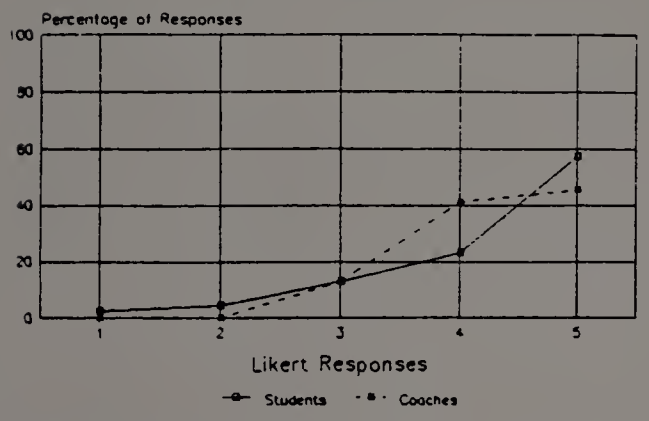



25. I can give details to explain how a solution will work.

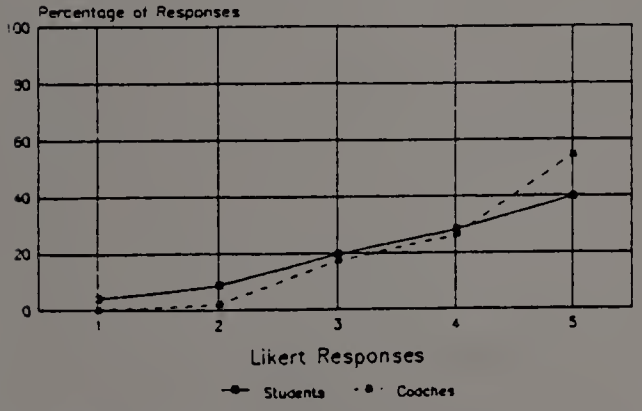
# % OF RESPONSES TO FUTURES QUESTIONS



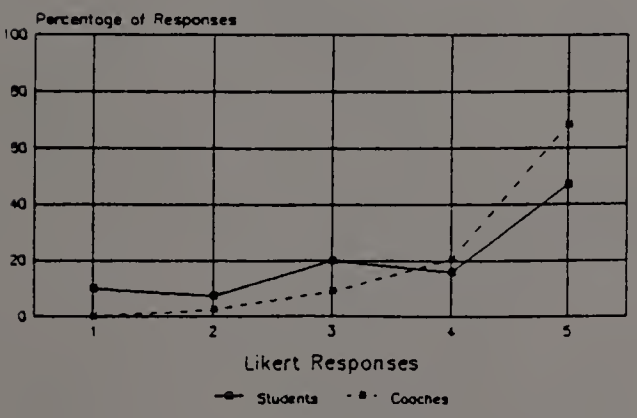

23. I understand that some problems don't have simple answers.




13. People can make a difference in what will happe in the future.



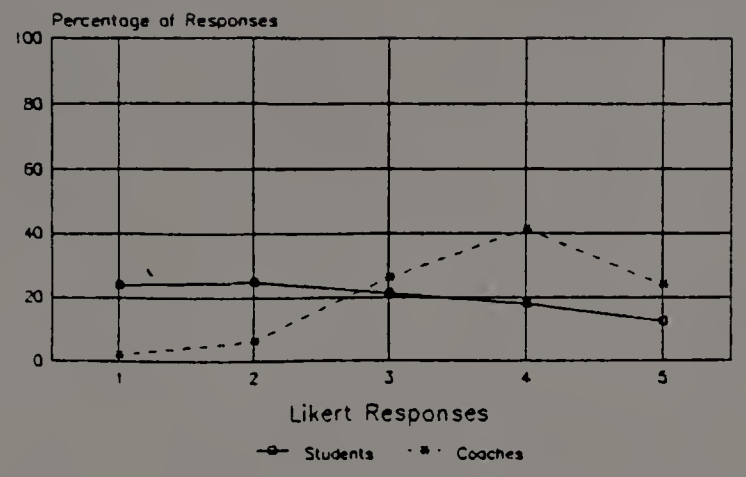

12. Future Problem Solving gives me a better idea of what it could be like in the future.




14. What I do has no effect on the future.

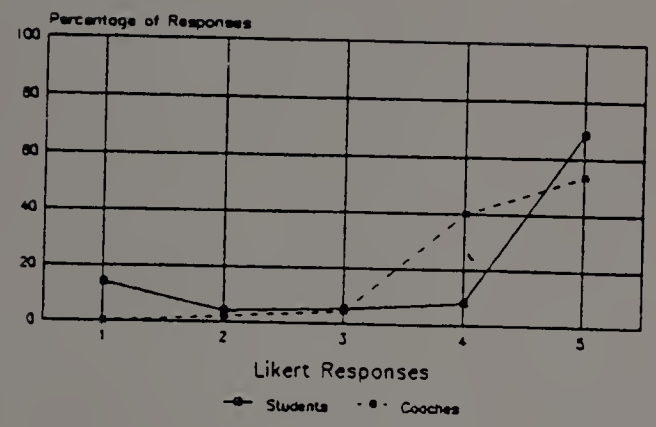
(Responses were reversed)

# % OF RESPONSES TO QUESTION ABOUT RESEARCH SKILLS




10. I know more places to look up information because of Future Problem Solving.

# % OF RESPONSES TO QUESTIONS ABOUT TEAMWORK

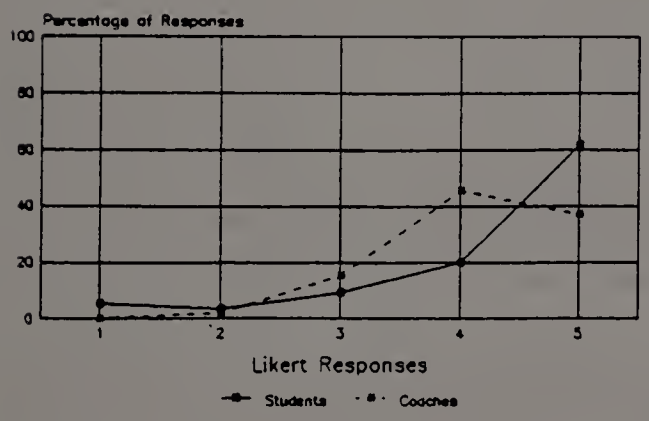



19. Other people's ideas are not important.

(Responses were reversed.)




20. It is important to know how to work as a team




24. Doing my work on time is important.

# APPENDIX U

# FACTOR ANALYSIS OF RESPONDENTS' DATA

## APPENDIX U.1 FACTOR ANALYSIS OF COACHES' DATA

| Factor | Eigenvalue | Pct. of Variance | Cum. Pct. |
|---|---|---|---|
| 1 | 6.19833 | 34.4 | 34.4 |
| 2 | 2.08285 | 11.6 | 46.0 |
| 3 | 1.50736 | 8.4 | 54.4 |
| 4 | 1.15358 | 6.4 | 60.8 |
| 5 | 1.00452 | 5.6 | 66.4 |

## APPENDIX U.2 FACTOR ANALYSIS OF STUDENTS' DATA

| Factor | Eigenvalue | Pct. of Variance | Cum. Pct. |
|---|---|---|---|
| 1 | 4.33882 | 24.1 | 24.1 |
| 2 | 1.58122 | 8.8 | 32.9 |
| 3 | 1.38326 | 7.7 | 40.6 |
| 4 | 1.11024 | 6.2 | 46.7 |

# APPENDIX V

## SUMMARY OF SELECTED DATA OF RESPONDENTS

Table V-1. Summary of Selected Demographic Data of Coaches and Students

| Demographic Element | Data As Reported by Population: Coaches | Students |
|---|---|---|
| Composition | Teachers (72%)<br>Parents (20%) | Gr. 4-6 (72%)<br>Gr. 7-9 (25%)<br>Gr.10-12 (3%) |
| Gender | Female (83%)<br>Male (17%) | Female (49.7%)<br>Male (50.3%) |
| Yrs. in FPS | Range 1 to 8 yrs.<br>1st Yr. (26%)<br>2nd Yr. (13%) | Range <1 to 6 yrs.<br>1st Yr. (70%)<br>2nd Yr. (13%) |
| When Met | During Sch. (48%)<br>During Sch. + (17%) | During Sch. (82%)<br>During Sch. + (5%) |
| Hrs/Wk for FPS | 0 to 1 Hr. (52%)<br>> 1 to 2 Hrs. (41%) | 0 to 1 Hr. (50%)<br>> 1 to 2 Hrs. (26%) |
| # Students/Coach | 1 to 10 (47%)<br>11 to 20 (22%)<br>21 to 30 (22%) | |
| # G/T Students | 70% | |
| Special Experiences | At Least 1 Exp. (91%)<br>FPSP Bowls (38%)<br>Special Events (21%)<br>Field Trips (7%)<br>Guest Speakers (7%)<br>Media Recog. (7%)<br>Other (24%) | At Least 1 Exp. (85%)<br>FPSP Bowls (39%)<br>Guest Speakers (38%)<br>Field Trips (28%)<br>Media Recog. (20%)<br>Special Events (14%)<br>Other (13%) |

Table V-2 Summary of Direction of Statistically Significant Correlations of Students' Demographics and Impact of FPSP on Student Skills

| | | *Demographic Factor | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Category | Component | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Bloom's Taxonomy | Knowledge | + | | | | | + | + | + |
| | Analysis | | | | | | + | + | + |
| | Synthesis | | | | | | | + | + |
| | Evaluation | | | | - | | | + | + |
| Communication | Oral | | | | | | | | + |
| | Written | + | + | + | | + | + | + | + |
| Creativity | Fluency | + | | + | - | | + | + | + |
| | Flexibility | | | | | | + | + | + |
| | Originality | | + | | | | + | | + |
| | Elaboration | | | + | | | + | + | + |
| Future | Others Affect | | | | - | | | | + |
| | I Affect | + | | | | | | + | + |
| | Complexity | | | | | + | | | + |
| | Awareness | | | | | | | | + |
| Research | More Sources | | | | | | | + | |
| Teamwork | Imp. of Others | + | | | + | + | | + | + |
| | Knowing How | - | - | | | + | | + | + |
| | Deadlines | - | - | | | | - | | |

* Explanation of Demographic Factors:

| No. | Meaning of Factor |
|---|---|
| 1. | Grade of Students |
| 2. | Number of Years in FPS |
| 3. | Number of Hours/Week in FPS Activities |
| 4. | Number of Hours/Week Met |
| 5. | Learned FPS in a Class or Program |
| 6. | Learned FPS Not in a Class or Program |
| 7. | Chose to Learn FPS |
| 8. | On a FPSP Team |

Table V-3. Summary of Statistically Significant T-Tests by Students' Demographics Reporting Certain Skills Acquired Through FPSP

| Demographic Element | | Advantages Shown By Population | |
|---|---|---|---|
| Gender | -- | Females | Males |
| | | Bloom: Knowledge<br>Creativity: Fluency<br>Future: I Affect<br>Future: No Simple Ans.<br>Tmwrk: Deadlines | none |
| Grade Level | -- | 7 through 12 | 4 through 6 |
| | | Creativity: Originality<br>Tmwrk: Imp. of Others | Future: No Simple Ans. |
| # Yrs in FPS | -- | More Than 1 Yr. | 0 to 1 Yr. |
| | | Creativity: Originality<br>Future: No Simple Ans.<br>Tmwrk: Imp. of Others | Future: People Make Diff. |
| # Hrs/Wk in FPS | -- | More Than 5 Hrs. | 0 to 5 Hrs. |
| | | Future: No Simple Ans.<br>Tmwrk: Deadlines | none |
| # Hrs/Wk Met | -- | More Than 5 Hrs. | 0 to 5 Hrs. |
| | | Tmwrk: Imp. of Others | Tmwrk: Imp. to Know How |
| When Met | -- | During School | Not During School |
| | | none | Creativity: Originality |

# BIBLIOGRAPHY


Allen, D.W. (1974). What the future of education might be. In Hipple (Ed.), (pp. 1-19). The future of education: 1975-2000. Pacific Palisades, CA: Goodyear Publishing Co., Inc.

Allen, D.W. and Plante, J. (1980). Looking at the future in education. In Jennings & Cornish (Eds.), (pp. 111-116). Education and the future. Washington, D.C.: World future Society.

Arent, R. (1979). The gifted child and feelings. G/C/T. Sept/Oct (9), 68-70.

Arnold, J.E. (1962) Education for innovation. In Parnes and Harding (Eds.), (pp.127-138). Creative thinking. NY: Charles Scribner's Sons.

Baer, J.M. (1988). Long-term effects of creativity training with middle school students. Journal of Early Adolescence. 8 (2), 183-193.

Barbe, W.B. and Renzulli, J.S. (Eds.) (1975). Psychology and education of the gifted. 2nd ed. New York: John Wiley & Sons.

Barrington, B.L. (1979). In the name of education. In Colangelo & Zaffrann (Eds.), (pp. 420-430). New voices in counseling the gifted. Dubuque, IA: Kendall/Hunt Publishing Co.

Barron, F. (1969). Creative person and the creative process. New York: Holt, Rinehart, & Winston.

Benjamin, S. (1989). An ideascape for education: What futurists recommend. Educational Leadership. Sept., 8-14.

Biondi, A.M. (1975). Creative problem-solving: From holding patterns to free flight. Buffalo, NY: Creative Education Foundation.

Bisignano, J., Bisignano, J., and Sanders, C. (1982). Creating your future. Tuscon, AZ: Kino Publications.

Bleedorn, B.D. (1981). Looking ahead - tested ideas in future studies. Buffalo, NY: D.O.K. Publishers.

Bloom, B.S. (Ed.) (1956). Taxonomy of educational objectives. New York: David McKay Co., Inc.

Callahan, C.M. (1978). Developing creativity in the gifted and talented. Reston, Virginia: Council for Exceptional Children.

Carnegie Council on Adolescent Development. (1989). Turning Points, Preparing American Youth For the 21st Century. New York: Carnegie Corporation.

Claassen, C. A. (1984). The evaluation primer. Cedar Rapids, IA: Future Problem Solving Program.

Clark, B. (1979). Growing up gifted. Columbus, OH: Charles E. Merrill Publishing Co.

Combs, A.W. (1981). What the future demands of education. Phi Delta Kappan. Jan.

Cornish, E. (1977). The study of the future. Washington, D.C.: World Future Society.

Crabbe, A.B. (1985a). The coach's guide to the future problem solving program. Cedar Rapids, IA: Future Problem Solving Program.

Crabbe, A.B. (Ed.). (1985b). For coaches by coaches. Cedar Rapids, IA: Future Problem Solving Program.

Crabbe, A.B. (Ed.). (1987). Thinking ahead: Teaching for the future. Laurinburg, NC: Future Problem Solving Program.

Cramond, Bonnie et al. (1990). Generalizability of creative problem solving procedures to real-life problems. Journal for the Education of the Gifted. 13 (2), 141-55.

Cramond, B., Martin, C.E. & Shaw, E.L. (1988, April). An investigation of the application of training in creative problem solving to content area problems. Paper presented at the meeting of the American Educational Research Assoc., New Orleans.

Cronbach, L.J. (1970). Intelligence? Creativity? A parsimonious re-interpretation of the Wallach-Kogan data. American Educational Research Journal. 7, 351-357.

Deroche, E.F. (1968). Creativity in the classroom. Journal of Creative Behavior. 2 (4), 239-241.

Dewey, J. (1910). How we think. Boston: D.C. Heath Co.

Dirkes, M.A. (1983). Anxiety in the gifted. Roeper Review. 6 (2), 68-70.

Eberle, B. and Stanish, B. (1980). CPS for kids: A resource book for teaching creative problem solving to children. Buffalo, NY: D.O.K. Publishers, Inc.

Feldhusen, J.F., Bahlke, S.J., and Treffinger, D.J. (1969). Teaching creative thinking. Elementary School Journal, 70, 48-53.

Feldhusen, J. and Clinkenbeard, P. (1986). Creativity instructional materials: a review of research. Journal of Creative Behavior. 20 (3), 153-182.

Fliegler, L., (Ed.). (1961). Curriculum planning for the gifted. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Freeman, J., (Ed.). (1985). The psychology of gifted children. New York: John Wiley & Sons, Ltd.

Friedman, M.I. (1984). Teaching higher order thinking skills to gifted students: A systematic approach. Springfield, IL: Charles C. Thomas.

Gallagher, J.J. (1975). Teaching the gifted child. (2nd edition). Boston, MA: Allyn & Bacon, Inc.

Gallagher, J.J. (1985). Teaching the gifted child. (3rd edition). Boston, MA: Allyn & Bacon, Inc.

George, W., Cohn, S., and Stanley, J. (Eds.). (1979) Educating the gifted: Acceleration and enrichment. Baltimore, MD: Johns Hopkins University Press.

Gerding-Oresic, S. (1987). It's not enough just to be gifted. Gifted Children Monthly. 8 (11), 7.

Getzels, J.G. and Jackson, P.W. (1962). Creativity and intelligence. New York:John Wiley & Sons, Inc.

Getzels, J.W. (1987). Creativity, intelligence, and problem finding: retrospect and prospect. In Isaksen (Ed.), (pp.88-102). Frontiers of creativity research. Buffalo, N.Y.: Bearly Limited.

Glass, G.V. (1978). Integrating findings: the meta-analysis of research. In Shulman, L.S. (Ed.). Review of research in education. Ithasca, IL: Peacock.

Gold, J.B. and Houtz, J.C. (1984). Enhancing the creative problem-solving skills of educable mentally retarded students. Perceptual-and-Motor-Skills. 58 (1), 247-253.

Goodlad, J.I. (1983). A study of schooling: some findings and hypotheses. Phi Delta Kappan. 64 (7), 465-470.

Gowan, J.C. (1977). Background and history of the gifted-child movement. In Stanley, George, & Solano (Eds.), (pp. 5-27). The gifted and the creative. Baltimore, MD: Johns Hopkins University Press.

Gowan, J.C., Demos, G.D. and Torrance, E.P. (Eds) (1967). Creativity: its educational implications. New York: John Wiley & Sons, Inc.

Guilford, J.P. (1962). Creativity: its measurement and development. In Parnes & Harding (Eds.), (pp.151-168). Creative thinking. NY: Charles Scribner's Sons.

Guilford, J.P. (1962). Factors that aid and hinder creativity. In Gowan, Demos & Torrance (Eds.) (1967), (pp. 106-123). Creativity: its educational implications. NY: John Wiley & Sons, Inc.

Guilford, J.P. (1967). Frames of reference for creative behavior in the arts. In Gowan, Demos, & Torrance (Eds.), (pp. 189-226). Creativity: its educational implications. New York: John Wiley & Sons, Inc.

Guilford, J.P. (1968). Intelligence, creativity, and their educational implications. San Diego: Robert Knapp.

Harrington, D.M., Block, J. & Block, J.H. (1983). Predicting creativity in preadolescence from divergent thinking in early childhood. Journal of Personality and Social Psychology. 45, 609-623.

Harris, L.D. (1971). Implementing a problem-oriented approach to learning. Journal of Creative Behavior. 5 (1), 60-69.

Henegar, L.E. (1984). Nurturing the creative promise in gifted disadvantaged youth. Journal of Creative Behavior. 18 (2), 109-16.

Hennessey, B.A. and Amabile, T.M. (1987). Creativity and learning. Washington, DC: National Education Association.

Hipple, T.W. (Ed.) (1974). The future of education: 1975-2000. Pacific Palisades, CA: Goodyear Publishing Co., Inc.

Houtz, J.C., Rosenfeld, S., and Tetenbaum, T. (1978). Creative thinking in gifted elementary school children. The Gifted Child Quarterly. 23 (4), 513-519.

Isaksen, S.G. (1983). Toward a model for the facilitation of creative problem solving. Journal of Creative Behavior. 17 (1), 18-31.

Isaksen, S.G. (Ed.) (1987). Frontiers of creativity research. Buffalo, N.Y.: Bearly Limited.

Isaksen, S.G. and Parnes, S.J. (1985). Curriculum planning for creative thinking and problem solving. Journal of Creative Behavior 19 (1), 1-29.

Jackson, D.M. (1980). Readings in foundations of gifted education. Guilford, CN: Special Learning Corp.

Jennings, L. and Cornish, J. (Eds.) (1980). Education and the future. Washington, D.C.: World Future Society.

Kaplan, S.N. (1974). Providing programs for the gifted and talented. Ventura, CA: Ventura County Superintendent of Schools Office.

Kauffman, D.L. Jr. (1980). Futurism and future studies. (2nd Ed.) Washington, D.C.: National Education Association.

Kirk, S.A. and Gallagher, J.J. (1986). Educating exceptional children. (5th Ed.). Boston: Houghton Mifflin Co.

Kogan, N. and Pankove, E. (1974). Long-term predictive validity of divergent-thinking tests: some negative evidence. Journal of Educational Psychology. 66, 802-810.

Kramer, L.R. (1985). Social interaction and perceptions of ability: A study of gifted adolescent females.

Lawless, R.F. (1977). Programs for gifted/talented/ creative children. Buffalo, NY: D.O.K. Publishers.

Libby, B. and Peterson, J. (Spring 1988). School programs for gifted and talented students. Quincy, MA: Mass. Dept. of Education.

Lowenfeld, V. (1962). Creativity: education's stepchild. In Parnes & Harding (Eds.), (pp. 9-17). Creative thinking. N.Y.: Charles Scribner's Sons.

MacKinnon, D.W. (1967). Identifying and developing creativity. In Gowan, Deoms, & Torrance (Eds.) (pp. 227-236) Creativity: its educational implications. New York: John Wiley & Sons, Inc.

MacKinnon, D.W. (1975). The nature and nurture of creative talent. In Barbe & Renzulli (Eds.). (pp. 151-167). Psychology and education of the gifted. New York: John Wiley & Sons.

Maker, C.J. (1982a). Curriculum development for the gifted. Rockville, MD: Aspen Systems Corp.

Maker, C.J. (1982b). Teaching models in edcuation of the gifted. Rockville, MD: Aspen Publication.

Mansfield, R.S., Busse, T.V. & Krepelka, E.J. (1978). The effectiveness of creativity training. Review of Educational Research. 48, 517-536.

Marland, S.P. (1972). Education of the gifted and talented. (Report to the Subcommittee on Education, Committee on Labor and Public Welfare, U.S. Senate). Washington, DC: U.S. Gov't Printing Office.

McCumsey, J. (1984). Exploring the future. Carthage, IL: Good Apple, Inc.

Nurek, J.T. (1985). A comparative analysis of selected personality characteristics and time allocation trends of teachers/coaches in the Michigan Future Problem Solving Program. (Doctoral dissertation, University of Michigan, 1984). Dissertation Abstracts International, 45, 1978A.

Osborne, A.F. (1967). Applied imagination. (3rd edition). New York: Charles Scribner.

Parker, J. (1978). The process: Cps in 5 steps. G/C/T. Mar./Apr. (2), 60-63.

Parnes, S.J. (1961). Effects of extended effort in creative problem solving. Journal of Educational Psychology. 52, 117-122.

Parnes, S.J. (1967). Creative behavior guidebook. New York: Charles Scribner.

Parnes, S.J. (1971). Creativity: developing human potential. Journal of Creative Behavior. 5 (1), 19-36.

Parnes, S.J. (1977). CPSI: the general system. Journal of Creative Behavior. 11 (1), 1-11.

Parnes, S.J. (1987). Visioneering -- state of the art. Journal of Creative Behavior. 21 (4), 283-299.

Parnes, S.J. and Harding, H.F. (Eds.) (1962). Creative thinking. New York: Charles Scribner's Sons.

Parnes, S.J. and Meadow, A. (1959). Effects of brainstorming instructions on creative problem-solving by trained and untrained subjects. Journal of Educational Psychology. 50, 171-176.

Parnes, S.J. & Meadow, A. (1960). Evaluation of persistence of effects produced by a creative problem-solving course. Psychology Reports. 7, 357-361.

Perrone, P.A. (1983). Giftedness: A personal-social phenomenon. Roeper Review. 6 (2), 63-64.

Perrone, P.A. and Male, R.A. (1981). The developmental education and guidance of talented learners. Rockville, MD: Aspen Systems Corp.

Renzulli, J.S. (1976). The enrichment triad method. Wethersfield, CT: Creative Learning Press.

Renzulli, J.S. (1977). The enrichment triad model: A guide for developing defensible programs for the gifted and talented. Mansfield Center, CN: Creative Learning Press, Inc.

Renzulli, J.S. (1979). What makes giftedness? Ventura, CA: Office of the Ventura County Superintendent of Schools.

Resnick, L.B. (1987). Education and learning to think. Washington, DC: National Academy Press.

Rose, L.H. and Lin, H.T. (1984). A meta-analysis of long-term creativity training programs. Journal of Creative Behavior. 18 (1), 11-22.

Rossman, J. (1931). The psychology of the inventor. Washington, DC: Inventors Publishing Co.

Sellin, D.F. and Birch, J. W. (1980). Educating gifted and talented learners. Rockville, MD: Aspen Systems Corp.

Shallcross, D. J. (1981). Teaching creative behavior. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Silvernail (1980). Gifted education for the 80's and beyond. Roeper Review, 2 (4), 16-18.

Sisk, D. (1987a). Creative teaching of the gifted. United States: McGraw-Hill, Inc.

Sisk, D. (1987b). The importance of gifted students creating images of the future. In Crabbe (Ed.), (pp. 3-5). Thinking ahead: Teaching for the future. Laurinburg, NC: Future Problem Solving Program.

Southern, W.T. & Jones, E.D. (Eds.) (1991). The academic acceleration of gifted children. NY: Teachers College Press.

Stacy, M. and Mitchell, B. (1979). Preparing gifted leaders for a futuristic society. G/C/T, Nov./Dec. (10), 7-8.

Stanley, J.C., George, W.C., and Solano, C.H. (Eds.) (1977). The gifted and the creative. Baltimore, MD: Johns Hopkins University Press.

Steinberg, L. (1985). Adolescence. New York: Alfred Knopf.

Sullivan, T. (1969) Developing problem-solving ability in slow learning elementary students. Journal of Creative Behavior. 3 (4), 284-290.

Tallent, M.K. (1985). Effects of the future problem solving program on gifted students' ability to solve futuristic problems. (Doctoral dissertation, Texas A & M University, 1985).

Tannebaum, A. (1983). Gifted children. New York: Macmillan.

Thompson, S. (1984). Refining the children of gold. G/C/T. Jan/Feb (31), 26-29.

Toffler, A. (1970). Future shock. New York: Bantam Books.

Torrance, E.P. (1960). Educational achievement of the highly intelligent and the highly creative:eight partail replications of the Getzels-Jackson study. Research Memorandum BER-60-18. Bureau of Education Research, Univ. of Minnesota.

Torrance, E.P. (1962). Developing creative thinking through school experiences. In Parnes & Harding (Eds.), (pp.31-47). Creative thinking. NY: Charles Scribner's Sons.

Torrance, E.P. (1967). Frames of reference for creative behavior in the arts. In Gowan, Demos, & Torrance (Eds.), (pp. 189-226). Creativity: its educational implications. NY: John Wiley & Sons, Inc.

Torrance, E.P. (1967). The Minnesota studies of creative behavior: National and international extensions. Journal of Creative Behavior. 1, 137-154.

Torrance, E.P. (1974). Interscholastic brainstorming and creative problem solving competition for the creatively gifted. Gifted Child Quarterly. 18 (1), 3-7.

Torrance, E.P. (1977). Creativity in the classroom. Washington, D.C.: National Education Asociation.

Torrance, E.P. (1980) . Creativity and futurism in education: retooling. Education. 100 (4), 298-311.

Torrance, E.P., Bruch, C. and Torrance, J. (1976). Interscholastic futuristic creative problem solving. Journal of Creative Behavior. 10 (2), 117-25.

Torrance, E.P. and Goff, K. (1989). A quiet revolution. Journal of Creative Behavior. 23 (2), 136-45.

Torrance, E.P. and Torrance, J.P. (1973). Is creativity teachable? Bloomington, Indiana: Phi Delta Kappa Educational Foundation.

Torrance, E.P. and Torrance, J.P. (1978). Developing instructional materials according to the Osborn-Parnes creative problem solving model. Creative Child and Adult Quarterly. 3 (2), 80-90.

Torrance, J.P., Torrance, E.P., and Crabbe, A.B. (1983). Handbook for training future problem solving teams. Cedar Rapids, IA: Future Problem Solving Program.

Treffinger, D.J. (1983). George's group: a creative problem-solving facilitation case study. Journal of Creative Behavior. 17 (1), 39-48.

Treffinger, D.J. and Ripple, R.E. (1969). Developing creative problem solving abilities and related attitudes through programmed instruction. Journal of Creative Behavior. 3 (2), 105-110.

Wallach, M.A. and Kogan, N. (1965). Modes of thinking in young children. New York, NY: Holt, Rinehart and Winston.

Wallach, M.A. and Wing, C.W. (1969). The talented student. NYC: Holt, Rinehart.

Wallace, G. (1945). The art of thought. London: C.A. Watts.

Weber, R.E. (1973). Human potential and the year 2000: The futures project of the New Jersey Dept. of Ed. - Part 1. Journal of Creative Behavior. 7 (2), 133-151.

Whaley, C.E. (1987). Images of future-self as motivational and behavioral determinant. In Crabbe (Ed.) (pp. 13-16). Thinking ahead: teaching for the future. Laurinburg, NC: Future Problem Solving Program.